VOLUME I, BOOK 2

APPENDIX D
FINAL REPORT

ENERGY SAVINGS OPPORTUNITY SURVEY (ESOS)

WHITE SANDS MISSILE RANGE
NEW MEXICO

Prepared for

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
FORT WORTH, TEXAS

Under

CONTRACT NO. DACA63-91-C-0152
EMC No. 1110-000

November 1992

By

E M C ENGINEERS, INC.
2750 South Wadsworth Blvd. Suite C-200
Denver, Colorado 80227

This study consists of VOLUME I BOOK 1, VOLUME I BOOK 2, AND VOLUME II

APPENDIX D

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DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
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APPENDIX D

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LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #2 - BLDG. T117 - ROOF INSULATION   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/09/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	0		$1,450	
B. SIOH COST	(5.5% of 1A) =			$80	
C. DESIGN COST	(6.0% of 1A) =			$87	
D. ENERGY CREDIT	(1A + 1B + 1C) =			$1,617	
E. SALVAGE VALUE	=			$0	
F. TOTAL INVESTMENT	(1D – 1E) =			---------->	$1,617

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	0.5	$9	15.23	$135	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	45	$100	19.64	$1,960	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		46	108.6		---------->	$2,095

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $0
1 DISCOUNT FACTOR (From Table A–2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $691
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$109
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$2,095
6	DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.30
7	SIMPLE PAYBACK (SPB)	(1F/4) =	14.88

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ROOF INSULATION - BLDG. 117

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ROOF INSULATION									
	R19 FIBERGLASS BATT INSULATION	SF	2525	0.49	1232.2	0.01	17.24	217.65		$1,449.86
	Labor Source: U.S. Dept of Labor, General Wage Decision No. NM91-1									
	Material costs from Means Building									
	Construction Cost Data, 1992									
	Unit prices include overhead & profit of 25%									
	TOTAL THIS SHEET									$1,449.86

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*****************************************************************************
*****************************************************************************
**                                                                         **
**                T R A C E   6 0 0   A N A L Y S I S                      **
**                                                                         **
**                by          **
**                                                                         **
*****************************************************************************
*****************************************************************************
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ESOS STUDY AT WSMR
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG. 117 ROOF INSUL.:ALT1-BSLN,ALT2-ECO ECO#1

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: June To November
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16: 5:37 12/20/91
Dataset Name: 117 .TM

AIRFLOW - ALTERNATIVE 1
BASELINE - BUILDING 117

SYSTEM SUMMARY
(Design Airflow Quantities)

System Number	System Type	Main: Outside Airflow (Cfm)	Main: Cooling Airflow (Cfm)	Main: Heating Airflow (Cfm)	Main: Return Airflow (Cfm)	Main: Exhaust Airflow (Cfm)	Auxil. Supply Airflow (Cfm)	Room Exhaust Airflow (Cfm)
1	SZ	0	0	1,987	2,484	497	0	0
Totals		0	0	1,987	2,484	497	0	0

CAPACITY - ALTERNATIVE 1
BASELINE - BUILDING 117

SYSTEM SUMMARY
(Design Capacity Quantities)

System Number	System Type	Cooling: Main Sys. Capacity (Tons)	Cooling: Aux. Sys. Capacity (Tons)	Cooling: Opt. Vent Capacity (Tons)	Cooling Totals (Tons)	Heating: Main Sys. Capacity (Btuh)	Heating: Aux. Sys. Capacity (Btuh)	Heating: Preheat Capacity (Btuh)	Heating: Reheat Capacity (Btuh)	Heating: Humidif. Capacity (Btuh)	Heating: Opt. Vent Capacity (Btuh)	Heating Totals (Btuh)
1	SZ	0.0	0.0	0.0	0.0	-100,000	0	0	0	0	0	-100,000
Totals		0.0	0.0	0.0	0.0	-100,000	0	0	0	0	0	-100,000

The building peaked at hour 16 month 6 with a capacity of 0.0 tons

ENGINEERING CHECKS - ALTERNATIVE 1
BASELINE - BUILDING 117

ENGINEERING CHECKS

System Number	Main/ Auxiliary	System Type	Percent Outside Air	Cooling: Cfm/ Sq Ft	Cooling: Cfm/ Ton	Cooling: Sq Ft /Ton	Cooling: Btuh/ Sq Ft	Heating: Cfm/ Sq Ft	Heating: Btuh/ Sq Ft	Floor Area Sq Ft
1	Main	SZ	0.00	0.00	0.0	0.0	0.00	1.00	-50.32	1,987

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0						Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0						OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)		Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00		0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00		0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00		0	0.00	-24,484	-24,484	26.25
Glass Solar	0	0		0	0.00		0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00		0	0.00	-17,729	-17,729	19.01
Wall Cond	0	0		0	0.00		0	0.00	-24,916	-24,916	26.71
Partition	0			0	0.00		0	0.00	0	0	0.00
Exposed Floor	0			0	0.00		0	0.00	-5,214	-5,214	5.59
Infiltration	0			0	0.00		0	0.00	-20,931	-20,931	22.44
Sub Total==>	0	0		0	0.00		0	0.00	-93,274	-93,274	100.00
Internal Loads											
Lights	0	0		0	0.00		0	0.00	0	0	0.00
People	0			0	0.00		0	0.00	0	0	0.00
Misc	0	0	0	0	0.00		0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00		0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00		0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00		0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00			0.00		0	0.00
Ret. Fan Heat		0		0	0.00			0.00		0	0.00
Duct Heat Pkup		0		0	0.00			0.00		0	0.00
OV/UNDR Sizing	0			0	0.00		0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00			0.00		0	0.00
Terminal Bypass		0	0	0	0.00			0.00		0	0.00
Grand Total==>	0	0	0	0	0.00		0	0.00	-93,274	-93,274	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	1,987		
Part	0		
ExFlr	1,987		
Roof	1,987	0	0
Wall	2,300	320	14

------------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-100.0	1,987	64.5	117.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,987	68.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-100.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	497
Supply	0	1,987
Mincfm	0	0
Return	0	1,987
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	1.00
Htg Btuh/SqFt	-50.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	117.0
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE - BUILDING 117

A I R F L O W   H E A T I N G   L O A D S

(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	BLDG 117	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE - BUILDING 117

A I R F L O W   H E A T   G A I N   A N D   L O S S

(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	BLDG 117	0	0	0	0	0	0	0	0	0	0	1,987
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,987
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	1,987
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,987
System	1 Block	0	0	0	0	0	0	0	0	0	0	1,987

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE - BUILDING 117

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	BLDG 117	0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68
Zone	1 Total/Ave.	0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68
System	1 Total/Ave.	0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68
Building		0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68

BUILDING AREAS - ALTERNATIVE 1
BASELINE - BUILDING 117

---------- B U I L D I N G   A R E A S ----------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	BLDG 117	1	1	1,987	1,987	0	1,987	0	0	1,987	320	14	1,980
Zone	1 Total/Ave.				1,987	0	1,987	0	0	1,987	320	14	1,980
System	1 Total/Ave.				1,987	0	1,987	0	0	1,987	320	14	1,980
Building					1,987	0	1,987	0	0	1,987	320	14	1,980

ASHRAE 90 ANALYSIS - ALTERNATIVE 1
BASELINE - BUILDING 117

---------- A S H R A E   9 0   A N A L Y S I S ----------

Overall Roof U-Value = 0.280 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.405 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.347 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 21.81 (Btu/Hr/Sq Ft)
Wall Overall Thermal Transfer Value (OTTVw) = 25.04 (Btu/Hr/Sq Ft)

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE - BUILDING 117

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-5,000	5	153	99.4	0	0	0.0	0	0
5 - 10	0.0	0	0	-10,000	6	181	198.7	0	0	0.0	0	0
10 - 15	0.0	0	0	-15,000	5	149	298.1	0	0	0.0	0	0
15 - 20	0.0	0	0	-20,000	8	220	397.5	0	0	0.0	0	0
20 - 25	0.0	0	0	-25,000	11	313	496.8	0	0	0.0	0	0
25 - 30	0.0	0	0	-30,000	8	237	596.2	0	0	0.0	0	0
30 - 35	0.0	0	0	-35,000	8	231	695.6	0	0	0.0	0	0
35 - 40	0.0	0	0	-40,000	11	318	794.9	0	0	0.0	0	0
40 - 45	0.0	0	0	-45,000	11	309	894.3	0	0	0.0	0	0
45 - 50	0.0	0	0	-50,000	6	180	993.7	0	0	0.0	0	0
50 - 55	0.0	0	0	-55,000	8	214	1,093.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-60,000	3	96	1,192.4	0	0	0.0	0	0
60 - 65	0.0	0	0	-65,000	6	180	1,291.7	0	0	0.0	0	0
65 - 70	0.0	0	0	-70,000	0	10	1,391.1	0	0	0.0	0	0
70 - 75	0.0	0	0	-75,000	0	0	1,490.5	0	0	0.0	0	0
75 - 80	0.0	0	0	-80,000	0	0	1,589.8	0	0	0.0	0	0
80 - 85	0.0	0	0	-85,000	0	0	1,689.2	0	0	0.0	0	0
85 - 90	0.0	0	0	-90,000	0	0	1,788.6	0	0	0.0	0	0
90 - 95	0.0	0	0	-95,000	0	0	1,887.9	0	0	0.0	0	0
95 - 100	0.0	0	0	-100,000	0	0	1,987.3	100	7,356	0.0	0	0
Hours Off	0.0	0	8,760	0	0	5,969	0.0	0	1,404	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	1,035	4	315	1
Feb	893	4	241	1
March	937	4	123	1
April	772	4	30	0
May	786	4	0	0
June	781	4	0	0
July	728	4	0	0
Aug	815	4	0	0
Sept	723	4	0	0
Oct	854	4	41	0
Nov	858	4	142	1
Dec	993	4	245	1
Total	10,175	4	1,136	1

Building Energy Consumption = 74,663 (Btu/Sq Ft/Year)   Floor Area = 1,987 (Sq Ft)
Source Energy Consumption = 76,431 (Btu/Sq Ft/Year)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ E Q U I P M E N T E N E R G Y C O N S U M P T I O N ------------------------------------

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS													
	ELEC	757	685	815	723	786	781	728	815	723	786	723	728	9,053
	PK	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
1	MISC LD													
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ2454		RESIDENT GAS FURNACE W-FAN											
	GAS	315	241	123	30	0	0	0	0	0	41	142	245	1,136
	PK	1.0	0.9	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.8	1.0
1	EQ5254		RESIDENTIAL FURNACE FAN											
	ELEC	278	208	122	48	0	0	0	0	0	68	134	265	1,123
	PK	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

---------- U T I L I T Y   P E A K   C H E C K S U M S ----------

Utility ELECTRIC DEMAND

Peak Value 4.3 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2454	RESIDENT GAS FURNACE W-FAN	0.4	8.58
Sub Total			0.4	8.58
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			4.0	91.42
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			4.0	91.42
Grand Total			4.3	100.00

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*****************************************************************************
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**                                                                         **
**              T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                         **
**              by              **
**                                                                         **
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ESOS STUDY AT WSMR
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG. 117 ROOF INSUL.:ALT1-BSLN,ALT2-ECO ECO#1

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: June To November
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16: 5:37 12/20/91
Dataset Name: 117 .TM

AIRFLOW - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

SYSTEM SUMMARY
(Design Airflow Quantities)

System Number	System Type	Main: Outside Airflow (Cfm)	Main: Cooling Airflow (Cfm)	Main: Heating Airflow (Cfm)	Main: Return Airflow (Cfm)	Main: Exhaust Airflow (Cfm)	Auxil. Supply Airflow (Cfm)	Room Exhaust Airflow (Cfm)
1	SZ	0	0	1,987	2,484	497	0	0
Totals		0	0	1,987	2,484	497	0	0

CAPACITY - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

SYSTEM SUMMARY
(Design Capacity Quantities)

System Number	System Type	Cooling: Main Sys. Capacity (Tons)	Cooling: Aux. Sys. Capacity (Tons)	Cooling: Opt. Vent Capacity (Tons)	Cooling Totals (Tons)	Heating: Main Sys. Capacity (Btuh)	Heating: Aux. Sys. Capacity (Btuh)	Heating: Preheat Capacity (Btuh)	Heating: Reheat Capacity (Btuh)	Heating: Humidif. Capacity (Btuh)	Heating: Opt. Vent Capacity (Btuh)	Heating Totals (Btuh)
1	SZ	0.0	0.0	0.0	0.0	-100,000	0	0	0	0	0	-100,000
Totals		0.0	0.0	0.0	0.0	-100,000	0	0	0	0	0	-100,000

The building peaked at hour 16 month 7 with a capacity of 0.0 tons

ENGINEERING CHECKS - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

ENGINEERING CHECKS

System Number	Main/ Auxiliary	System Type	Percent Outside Air	Cooling: Cfm/ Sq Ft	Cooling: Cfm/ Ton	Cooling: Sq Ft /Ton	Cooling: Btuh/ Sq Ft	Heating: Cfm/ Sq Ft	Heating: Btuh/ Sq Ft	Floor Area Sq Ft
1	Main	SZ	0.00	0.00	0.0	0.0	0.00	1.00	-50.32	1,987

System 1 Peak SZ - SINGLE ZONE

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-3,847	-3,847	5.30
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-17,729	-17,729	24.41
Wall Cond	0	0		0	0.00	0	0.00	-24,916	-24,916	34.30
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-5,214	-5,214	7.18
Infiltration	0			0	0.00	0	0.00	-20,931	-20,931	28.82
Sub Total==>	0	0		0	0.00	0	0.00	-72,638	-72,638	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-72,638	-72,638	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	1,987		
Part	0		
ExFlr	1,987		
Roof	1,987	0	0
Wall	2,300	320	14

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-100.0	1,987	53.6	106.2
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,987	68.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-100.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	497
Supply	0	1,987
Mincfm	0	0
Return	0	1,987
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	1.00
Htg Btuh/SqFt	-50.32

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	106.2
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	BLDG 117	0	0	0	0	0	0	0	0	0
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone 1	Block	0	0	0	0	0	0	0	0	0
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0
System 1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	BLDG 117	0	0	0	0	0	0	0	0	0	0	1,987
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,987
Zone 1	Block	0	0	0	0	0	0	0	0	0	0	1,987
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,987
System 1	Block	0	0	0	0	0	0	0	0	0	0	1,987

BUILDING U-VALUES - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	BLDG 117	0.000	0.328	0.000	0.000	0.044	1.140	1.259	0.286	0.000	30.4	10.68
Zone 1	Total/Ave.	0.000	0.328	0.000	0.000	0.044	1.140	1.259	0.286	0.000	30.4	10.68
System 1	Total/Ave.	0.000	0.328	0.000	0.000	0.044	1.140	1.259	0.286	0.000	30.4	10.68
Building		0.000	0.328	0.000	0.000	0.044	1.140	1.259	0.286	0.000	30.4	10.68

BUILDING AREAS - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	BLDG 117	1	1	1,987	1,987	0	1,987	0	0	1,987	320	14	1,980
Zone	1 Total/Ave.				1,987	0	1,987	0	0	1,987	320	14	1,980
System	1 Total/Ave.				1,987	0	1,987	0	0	1,987	320	14	1,980
Building					1,987	0	1,987	0	0	1,987	320	14	1,980

ASHRAE 90 ANALYSIS - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

ASHRAE 90 ANALYSIS

Overall Roof U-Value = 0.044 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.405 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.238 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 2.26 (Btu/Hr/Sq Ft)
Wall Overall Thermal Transfer Value (OTTVw) = 25.04 (Btu/Hr/Sq Ft)

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

SYSTEM LOAD PROFILE

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-5,000	9	214	99.4	0	0	0.0	0	0
5 - 10	0.0	0	0	-10,000	8	181	198.7	0	0	0.0	0	0
10 - 15	0.0	0	0	-15,000	9	202	298.1	0	0	0.0	0	0
15 - 20	0.0	0	0	-20,000	11	266	397.5	0	0	0.0	0	0
20 - 25	0.0	0	0	-25,000	12	280	496.8	0	0	0.0	0	0
25 - 30	0.0	0	0	-30,000	20	470	596.2	0	0	0.0	0	0
30 - 35	0.0	0	0	-35,000	12	275	695.6	0	0	0.0	0	0
35 - 40	0.0	0	0	-40,000	9	208	794.9	0	0	0.0	0	0
40 - 45	0.0	0	0	-45,000	10	239	894.3	0	0	0.0	0	0
45 - 50	0.0	0	0	-50,000	0	0	993.7	0	0	0.0	0	0
50 - 55	0.0	0	0	-55,000	0	0	1,093.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-60,000	0	0	1,192.4	0	0	0.0	0	0
60 - 65	0.0	0	0	-65,000	0	0	1,291.7	0	0	0.0	0	0
65 - 70	0.0	0	0	-70,000	0	0	1,391.1	0	0	0.0	0	0
70 - 75	0.0	0	0	-75,000	0	0	1,490.5	0	0	0.0	0	0
75 - 80	0.0	0	0	-80,000	0	0	1,589.8	0	0	0.0	0	0
80 - 85	0.0	0	0	-85,000	0	0	1,689.2	0	0	0.0	0	0
85 - 90	0.0	0	0	-90,000	0	0	1,788.6	0	0	0.0	0	0
90 - 95	0.0	0	0	-95,000	0	0	1,887.9	0	0	0.0	0	0
95 - 100	0.0	0	0	-100,000	0	0	1,987.3	100	7,751	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,425	0.0	0	1,009	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	1,027	4	196	1
Feb	919	4	150	1
March	925	4	78	0
April	764	4	14	0
May	786	4	0	0
June	781	4	0	0
July	728	4	0	0
Aug	815	4	0	0
Sept	723	4	0	0
Oct	823	4	15	0
Nov	832	4	84	0
Dec	911	4	148	1
Total	10,034	4	685	1

Building Energy Consumption = 51,701 (Btu/Sq Ft/Year) Floor Area = 1,987 (Sq Ft)
Source Energy Consumption = 52,767 (Btu/Sq Ft/Year)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
		Monthly Consumption												
0	LIGHTS													
	ELEC	757	685	815	723	786	781	728	815	723	786	723	728	9,053
	PK	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
1	MISC LD													
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ2454		RESIDENT GAS FURNACE W-FAN											
	GAS	196	150	78	14	0	0	0	0	0	15	84	148	685
	PK	0.7	0.7	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.6	0.7
1	EQ5254		RESIDENTIAL FURNACE FAN											
	ELEC	270	234	110	41	0	0	0	0	0	37	108	182	982
	PK	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y P E A K C H E C K S U M S --------------------------------------

Utility ELECTRIC DEMAND

Peak Value 4.3 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2454	RESIDENT GAS FURNACE W-FAN	0.4	8.58
Sub Total			0.4	8.58
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			4.0	91.42
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			4.0	91.42
Grand Total			4.3	100.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #4 - BLDG.1830 - LOWER CEILINGS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$93,109	
B. SIOH COST		(5.5% of 1A) =	$5,121	
C. DESIGN COST		(6.0% of 1A) =	$5,587	
D. ENERGY CREDIT		(1A + 1B + 1C) =	$103,816	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT		(1D - 1E) =	---------->	$103,816

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	(2)	($38)	15.23	($584)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	69	$152	19.64	$2,995	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		67	114.1		---------->	$2,410

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = ($234)

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = ($3,435)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$23,770	10	0.64	$15,213
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$23,770			$15,213

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $11,778

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $795

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.03

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$831
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$14,188
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.14
7 SIMPLE PAYBACK (SPB)	(1F/4) =	124.94

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): LOWER CEILING – BLDG 1830

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	SUSPENDED CEILING W/ 2'x4'x3/4" PANELS	SF	6383	1.10	7021.3	0.02	35.55	4765.23		$11,786.53
	FLUOR. LAMPS / TROFFERS IN CEILING GRID	EA	129	65.00	8385.00	1.51	38.95	7582.05		$15,967.05
	INSTALL GAS FURNANCES	EA	3	3581	10743.00	32.00	35.73	3430.08		$14,173.08
	EXTEND EXSTNG & ADD NEW GALV. DUCT	LBS	8200	1	4428.00	0.08	37.05	25520.04		$29,948.04
	INSULATE DUCTWORK	SF	6333	0	2849.85	0.04	36.15	9615.39		$12,465.24
	SUPPLY AIR DIFFUSERS	EA	52	56	2912.00	0.67	39.70	1376.95		$4,288.95
	DEMOLITION	EA	1			160.00	28.00	4480.00		$4,480.00
	TOTAL									$93,108.89

Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25 % overhead & profit; Labor rates include overhead & profit

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**                                                                         **
**                T R A C E   6 0 0   A N A L Y S I S                      **
**                                                                         **
**                by              **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 1830
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
LOWER CEILING - ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 19:50:54 2/ 4/92
Dataset Name: 1830 .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

V 600
PAGE

System 1 Block UH - UNIT HEATERS

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-17,626	-17,626	7.02
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-22,192	-22,192	8.84
Wall Cond	0	0		0	0.00	0	0.00	-103,554	-103,554	41.26
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-19,485	-19,485	7.76
Infiltration	0			0	0.00	0	0.00	-88,133	-88,133	35.11
Sub Total==>	0	0		0	0.00	0	0.00	-250,990	-250,990	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-250,990	-250,990	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	14,688		
Part	1,600		
ExFlr	558		
Roof	7,344	0	0
Wall	6,553	369	6

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-393.3	6,800	49.1	109.5
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-393.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,958
Supply	0	6,800
Mincfm	0	0
Return	0	6,800
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.46
Htg Btuh/SqFt	-26.78

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	109.5
Plenum	0.0	72.0
Return	0.0	71.0
Ret/OA	0.0	71.0
Runarnd	0.0	72.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

System 2 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 0/ 0 * Mo/Hr: 0/ 0 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 * OADB: 0 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-8,237	-8,237	8.81
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-13,016	-13,016	13.92
Wall Cond	0	0		0	0.00	*	0	0.00	*	-35,823	-35,823	38.30
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	-36,446	-36,446	38.97
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-93,522	-93,522	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-93,522	-93,522	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	7,488		
Part	600		
ExFlr	0		
Roof	3,744	0	0
Wall	2,543	235	9

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-382.5	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-382.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	874
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-51.08

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1830

A I R F L O W   H E A T   G A I N   A N D   L O S S

(At time of Coil Peak)

		Heating										
Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	ROOM 1	0	0	0	0	0	0	0	0	0	0	3,400
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	3,400
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	3,400
2	ROOM 2	0	0	0	0	0	0	0	0	0	0	3,400
Zone	2 Total/Ave.	0	0	0	0	0	0	0	0	0	0	3,400
Zone	2 Block	0	0	0	0	0	0	0	0	0	0	3,400
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	6,800
System	1 Block	0	0	0	0	0	0	0	0	0	0	6,800
3	ROOM 3	0	0	0	0	0	0	0	0	0	0	0
Zone	3 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	3 Block	0	0	0	0	0	0	0	0	0	0	0
4	ROOM 4	0	0	0	0	0	0	0	0	0	0	0
Zone	4 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	4 Block	0	0	0	0	0	0	0	0	0	0	0
System	2 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	2 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1830

B U I L D I N G   U - V A L U E S

		Room U-Values (Btu/hr/sqft/F)									Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.		
1	ROOM 1	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46
2	ROOM 2	0.000	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	78.3	16.56
Zone	2 Total/Ave.	0.000	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	78.3	16.56
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	57.8	12.01
3	ROOM 3	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30
Zone	3 Total/Ave.	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30
4	ROOM 4	0.000	0.000	0.000	0.000	0.050	1.140	1.259	0.358	0.000	74.1	15.71
Zone	4 Total/Ave.	0.000	0.000	0.000	0.000	0.050	1.140	1.259	0.358	0.000	74.1	15.71
System	2 Total/Ave.	0.388	0.000	0.000	0.000	0.050	1.140	1.259	0.358	0.000	52.8	11.01
Building		0.388	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	56.1	11.67

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1830

---------- B U I L D I N G   A R E A S ----------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	7,344	7,344	1,600	402	0	0	0	38	1	3,781
Zone	1 Total/Ave.				7,344	1,600	402	0	0	0	38	1	3,781
2	ROOM 2	1	1	7,344	7,344	0	156	0	0	7,344	331	12	2,403
Zone	2 Total/Ave.				7,344	0	156	0	0	7,344	331	12	2,403
System	1 Total/Ave.				14,688	1,600	558	0	0	7,344	369	6	6,184
3	ROOM 3	1	1	3,744	3,744	600	0	0	0	0	15	1	1,467
Zone	3 Total/Ave.				3,744	600	0	0	0	0	15	1	1,467
4	ROOM 4	1	1	3,744	3,744	0	0	0	0	3,744	220	21	840
Zone	4 Total/Ave.				3,744	0	0	0	0	3,744	220	21	840
System	2 Total/Ave.				7,488	600	0	0	0	3,744	235	9	2,308
Building					22,176	2,200	558	0	0	11,088	604	7	8,491

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-38,792	24	681	340.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-77,584	27	780	680.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-116,375	23	649	1,020.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-155,167	17	483	1,360.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-193,959	9	266	1,700.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-232,751	0	0	2,040.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-271,543	0	0	2,380.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-310,334	0	0	2,720.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-349,126	0	0	3,060.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-387,918	0	0	3,400.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-426,710	0	0	3,740.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-465,502	0	0	4,080.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-504,293	0	0	4,420.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-543,085	0	0	4,760.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-581,877	0	0	5,100.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-620,669	0	0	5,440.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-659,461	0	0	5,780.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-698,253	0	0	6,120.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-737,044	0	0	6,460.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-775,836	0	0	6,800.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	5,901	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	5,695	28	1,466	5
Feb	5,150	28	1,108	5
March	5,897	28	279	3
April	5,085	28	0	1
May	5,527	28	0	0
June	5,493	28	0	0
July	5,119	28	0	0
Aug	5,731	28	0	0
Sept	5,085	28	0	0
Oct	5,527	28	0	0
Nov	5,413	28	290	2
Dec	5,481	28	1,077	4
Total	65,205	28	4,221	5

Building Energy Consumption = 29,071 (Btu/Sq Ft/Year)   Floor Area = 22,176 (Sq Ft)
Source Energy Consumption = 29,660 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 28.4 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.5	1.76
Sub Total			0.5	1.76
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			27.9	98.24
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			27.9	98.24
Grand Total			28.4	100.00

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******************************************************************************
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**                                                                          **
**              T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                          **
**              by          **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 1830
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
LOWER CEILING - ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 5:46:36 2/ 4/92
Dataset Name: 1830 .TM

System 1 Block UH - UNIT HEATERS

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ****

Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-13,550	-13,550	5.88
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-19,289	-19,289	8.36
Wall Cond	0	0		0	0.00	*	0	0.00	*	-97,532	-97,532	42.29
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-18,666	-18,666	8.09
Infiltration	0			0	0.00	*	0	0.00	*	-81,570	-81,570	35.37
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-230,607	-230,607	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-230,607	-230,607	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	14,688		
Part	1,600		
ExFlr	558		
Roof	7,344	0	0
Wall	6,553	369	6

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-393.3	6,800	42.5	102.9
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-393.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,958
Supply	0	6,800
Mincfm	0	0
Return	0	6,800
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.46
Htg Btuh/SqFt	-26.78

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	102.9
Plenum	0.0	65.0
Return	0.0	67.5
Ret/OA	0.0	67.5
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

System 2 Block UH - UNIT HEATERS

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-6,908	-6,908	7.53
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-12,242	-12,242	13.35
Wall Cond	0	0		0	0.00	0	0.00	-36,496	-36,496	39.78
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-36,088	-36,088	39.34
Sub Total==>	0	0		0	0.00	0	0.00	-91,734	-91,734	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-91,734	-91,734	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB Deg F	Entering WB Deg F	Entering HR Grains	Leaving DB Deg F	Leaving WB Deg F	Leaving HR Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	7,488		
Part	600		
ExFlr	0		
Roof	3,744	0	0
Wall	2,543	235	9

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-382.5	1,821	-99.4	120.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-382.5			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	874
Supply	0	1,821
Mincfm	0	0
Return	0	1,821
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.24
Htg Btuh/SqFt	-51.08

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	120.0
Plenum	0.0	65.0
Return	0.0	67.4
Ret/OA	0.0	67.4
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
LOWER CEILINGS, BLDG. 1830

A I R F L O W H E A T G A I N A N D L O S S
(At time of Coil Peak)

Room Number	Description	Heating Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	ROOM 1	0	0	0	0	0	0	0	0	0	0	3,400
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	3,400
Zone 1	Block	0	0	0	0	0	0	0	0	0	0	3,400
2	ROOM 2	0	0	0	0	0	0	0	0	0	0	3,400
Zone 2	Total/Ave.	0	0	0	0	0	0	0	0	0	0	3,400
Zone 2	Block	0	0	0	0	0	0	0	0	0	0	3,400
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	6,800
System 1	Block	0	0	0	0	0	0	0	0	0	0	6,800
3	ROOM 3	0	0	0	0	0	0	0	0	0	0	867
Zone 3	Total/Ave.	0	0	0	0	0	0	0	0	0	0	867
Zone 3	Block	0	0	0	0	0	0	0	0	0	0	867
4	ROOM 4	0	0	0	0	0	0	0	0	0	0	954
Zone 4	Total/Ave.	0	0	0	0	0	0	0	0	0	0	954
Zone 4	Block	0	0	0	0	0	0	0	0	0	0	954
System 2	Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,821
System 2	Block	0	0	0	0	0	0	0	0	0	0	1,821

BUILDING U-VALUES - ALTERNATIVE 2
LOWER CEILINGS, BLDG. 1830

B U I L D I N G U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	ROOM 1	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46
Zone 1	Total/Ave.	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46
2	ROOM 2	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	78.3	16.56
Zone 2	Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	78.3	16.56
System 1	Total/Ave.	0.388	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	57.8	12.01
3	ROOM 3	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30
Zone 3	Total/Ave.	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30
4	ROOM 4	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.358	0.000	74.1	15.71
Zone 4	Total/Ave.	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.358	0.000	74.1	15.71
System 2	Total/Ave.	0.388	0.000	0.000	0.000	0.045	1.140	1.259	0.358	0.000	52.8	11.01
Building		0.388	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	56.1	11.67

BUILDING AREAS - ALTERNATIVE 2
LOWER CEILINGS, BLDG. 1830

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	7,344	7,344	1,600	402	0	0	0	38	1	3,781
Zone	1 Total/Ave.				7,344	1,600	402	0	0	0	38	1	3,781
2	ROOM 2	1	1	7,344	7,344	0	156	0	0	7,344	331	12	2,403
Zone	2 Total/Ave.				7,344	0	156	0	0	7,344	331	12	2,403
System	1 Total/Ave.				14,688	1,600	558	0	0	7,344	369	6	6,184
3	ROOM 3	1	1	3,744	3,744	600	0	0	0	0	15	1	1,467
Zone	3 Total/Ave.				3,744	600	0	0	0	0	15	1	1,467
4	ROOM 4	1	1	3,744	3,744	0	0	0	0	3,744	220	21	840
Zone	4 Total/Ave.				3,744	0	0	0	0	3,744	220	21	840
System	2 Total/Ave.				7,488	600	0	0	0	3,744	235	9	2,308
Building					22,176	2,200	558	0	0	11,088	604	7	8,491

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-38,792	31	746	431.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-77,584	24	587	862.1	0	0	0.0	0	0
10 - 15	0.0	0	0	-116,375	21	509	1,293.1	0	0	0.0	0	0
15 - 20	0.0	0	0	-155,167	18	430	1,724.1	0	0	0.0	0	0
20 - 25	0.0	0	0	-193,959	6	150	2,155.2	0	0	0.0	0	0
25 - 30	0.0	0	0	-232,751	0	0	2,586.2	0	0	0.0	0	0
30 - 35	0.0	0	0	-271,543	0	0	3,017.3	0	0	0.0	0	0
35 - 40	0.0	0	0	-310,334	0	0	3,448.3	0	0	0.0	0	0
40 - 45	0.0	0	0	-349,126	0	0	3,879.3	0	0	0.0	0	0
45 - 50	0.0	0	0	-387,918	0	0	4,310.4	0	0	0.0	0	0
50 - 55	0.0	0	0	-426,710	0	0	4,741.4	0	0	0.0	0	0
55 - 60	0.0	0	0	-465,502	0	0	5,172.4	0	0	0.0	0	0
60 - 65	0.0	0	0	-504,293	0	0	5,603.5	0	0	0.0	0	0
65 - 70	0.0	0	0	-543,085	0	0	6,034.5	0	0	0.0	0	0
70 - 75	0.0	0	0	-581,877	0	0	6,465.6	0	0	0.0	0	0
75 - 80	0.0	0	0	-620,669	0	0	6,896.6	0	0	0.0	0	0
80 - 85	0.0	0	0	-659,461	0	0	7,327.6	0	0	0.0	0	0
85 - 90	0.0	0	0	-698,253	0	0	7,758.7	0	0	0.0	0	0
90 - 95	0.0	0	0	-737,044	0	0	8,189.7	0	0	0.0	0	0
95 - 100	0.0	0	0	-775,836	0	0	8,620.7	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,338	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	5,893	29	1,326	5
Feb	5,318	29	981	5
March	6,075	29	151	3
April	5,085	28	0	0
May	5,527	28	0	0
June	5,493	28	0	0
July	5,119	28	0	0
Aug	5,731	28	0	0
Sept	5,085	28	0	0
Oct	5,527	28	0	0
Nov	5,315	29	142	2
Dec	5,648	29	931	4
Total	65,817	29	3,532	5

Building Energy Consumption = 26,055 (Btu/Sq Ft/Year)   Floor Area = 22,176 (Sq Ft)
Source Energy Consumption = 26,547 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 28.7 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.5	1.74
2	EQ2201	GAS FIRED UNIT HEATER	0.3	1.04
Sub Total			0.8	2.78
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			27.9	97.22
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			27.9	97.22
Grand Total			28.7	100.00

JOB WSMR Proj. No 1110-000

SHEET NO. 1 OF 1

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY A.J.N. DATE 4-6-92

CHECKED BY ______ DATE ______

SCALE ______

Bldg. 1830

1.) # of Unit Heaters (24,500 BTUH TO 45,000 BTUH) = 14
2.) " (100,000 BTUH) = 1

3.) # of I.R. Heaters (240,000 TO 270,000 BTUH) = 17

Replacement Cost

Means Mech. Cost Data: \$520.00 ea Unit Heaters (1.) \$520.00 X 14 = 7280.00
(1992) pg. 180 40 MBH
(Line 2020)

" " \$765.00 ea " " (2.) \$765.00 X 1 = \$765.00
(Line 2080)

" "
Pg. 176 \$925.00 ea IR HEATERS (3.) \$925.00 X 17 = \$15,725
Line 0240

\$23,770.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 - P100 - ENERGY EFFICIENT WINDOWS   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A.	CONSTRUCTION COST	=	$57,602	
B.	SIOH COST	(5.5% of 1A) =	$3,168	
C.	DESIGN COST	(6.0% of 1A) =	$3,456	
D.	ENERGY CREDIT	(1A + 1B + 1C) =	$64,227	
E.	SALVAGE VALUE	=	$0	
F.	TOTAL INVESTMENT	(1D - 1E) =	————>	$64,227

2 ENERGY SAVINGS (+) / COST (-)

	FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	$18.37	(10)	($189)	15.23	($2,874)	
B.	DIST		0	$0	17.28	$0	
C.	NAT GAS	$2.21	199	$439	19.64	$8,627	
D.	PAPER		0	$0		$0	
E.	COAL			$0	16.22	$0	
F.	TOTAL		188	250.6		————>	$5,753

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = $0
  1 DISCOUNT FACTOR (From Table A-2) = 14.68
  2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST
  1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,899
    a IF 3D1 => 3C THEN GO TO 4
    b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =
    c IF 3D1b => 1 THEN GO TO 4
    d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$251
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$5,753
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.09
7	SIMPLE PAYBACK (SPB)	(1F/4) =	256.34

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #9 - P102 - ENERGY EFFICIENT WINDOWS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$27,622		
B. SIOH COST	(5.5% of 1A) =	$1,519		
C. DESIGN COST	(6.0% of 1A) =	$1,657		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$30,799		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	————>	$30,799	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	0	$6	15.23	$95	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	43	$95	19.64	$1,860	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		43	100.9		————>	$1,955

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$645	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$101
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,955
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.06
7 SIMPLE PAYBACK (SPB)	(1F/4) =	305.17

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #9 - P124 - ENERGY EFFICIENT WINDOWS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$102,092	
B. SIOH COST	(5.5% of 1A) =		$5,615	
C. DESIGN COST	(6.0% of 1A) =		$6,126	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$113,833	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		---------->	$113,833

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	5	$83	15.23	$1,268	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	332	$734	19.64	$14,412	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		336	817.1		---------->	$15,681

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$5,175	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$817
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$15,681
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	0.14
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	139.31

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range — REGION: 4 — PROJECT NO: DACA 63-91-C-0152

PROJECT TITLE: ECO #9 – P128 – ENERGY EFFICIENT WINDOWS — FISCAL YEAR: 1992

DISCRETE PORTION NAME: TOTAL

ANALYSIS DATE: 06/04/92 — ECONOMIC LIFE: 25 — PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$72,187	
B. SIOH COST	(5.5% of 1A) =		$3,970	
C. DESIGN COST	(6.0% of 1A) =		$4,331	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$80,488	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$80,488

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	6	$115	15.23	$1,757	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	130	$287	19.64	$5,633	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		136	402.2		————>	$7,390

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$2,439	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$402
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$7,390
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.09
7 SIMPLE PAYBACK (SPB)	(1F/4) =	200.13

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 – P129 – ENERGY EFFICIENT WINDOWS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT				
A. CONSTRUCTION COST	=		$37,866	
B. SIOH COST	(5.5% of 1A) =		$2,083	
C. DESIGN COST	(6.0% of 1A) =		$2,272	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$42,220	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$42,220

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	5	$89	15.23	$1,350	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	69	$152	19.64	$2,982	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		73	240.5		————>	$4,332

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $0
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,430
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$240
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$4,332
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.10
7 SIMPLE PAYBACK (SPB)	(1F/4) =	175.57

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #9 - P143 - ENERGY EFFICIENT WINDOWS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$37,866		
B. SIOH COST	(5.5% of 1A) =	$2,083		
C. DESIGN COST	(6.0% of 1A) =	$2,272		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$42,220		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	---------->	$42,220	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	5	$89	15.23	$1,350	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	69	$152	19.64	$2,982	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		73	240.5		---------->	$4,332

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$1,430	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$240
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$4,332
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.10
7 SIMPLE PAYBACK (SPB)	(1F/4) =	175.57

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 - P501A - ENERGY EFFICIENT WINDOWS - CLEAR GLASS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/11/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$39,008	
B. SIOH COST	(5.5% of 1A) =	$2,145	
C. DESIGN COST	(6.0% of 1A) =	$2,340	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$43,494	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D - 1E) =	————>	$43,494

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	33	$213	15.23	$3,245	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		33	213.1		————>	$3,245

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$1,404	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$20,611	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$20,611
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$1,071	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.10	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$1,617
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$23,856
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.55
7 SIMPLE PAYBACK (SPB)	(1F/4) =	26.90

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 - P501A - ENERGY EFFICIENT WINDOWS - GREY GLASS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/11/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$42,361	
B. SIOH COST	(5.5% of 1A) =	$2,330	
C. DESIGN COST	(6.0% of 1A) =	$2,542	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$47,233	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D - 1E) =	——————>	$47,233

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	33	$213	15.23	$3,245	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		33	213.1		——————>	$3,245

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = $1,736
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $25,477

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $25,477

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,071
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.09
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = $1,949
5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = $28,722
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.61
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)
7 SIMPLE PAYBACK (SPB) (1F/4) = 24.24

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 – P501B – ENERGY EFFICIENT WINDOWS – CLEAR GLASS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/11/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$27,507	
B. SIOH COST	(5.5% of 1A) =		$1,513	
C. DESIGN COST	(6.0% of 1A) =		$1,650	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$30,670	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		---------->	$30,670

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	2	$11	15.23	$163	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	67	$149	19.64	$2,925	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		69	159.6		---------->	$3,088

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $39
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $573

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $573

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,019
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$199
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$3,661
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	0.12
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	154.41

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 - P502 - ENERGY EFFICIENT WINDOWS - CLEAR GLASS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$26,747		
B. SIOH COST	(5.5% of 1A) =	$1,471		
C. DESIGN COST	(6.0% of 1A) =	$1,605		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$29,823		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$29,823	

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	30	$196	15.23	$2,988	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		30	196.2		————>	$2,988

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $1,209
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $17,748

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $17,748

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $986
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.13
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$1,405
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$20,736
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.70
7 SIMPLE PAYBACK (SPB)	(1F/4) =	21.22

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 – P502 – ENERGY EFFICIENT WINDOWS – GREY GLASS   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/11/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$29,046		
B. SIOH COST	(5.5% of 1A) =	$1,598		
C. DESIGN COST	(6.0% of 1A) =	$1,743		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$32,386		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$32,386	

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	29	$187	15.23	$2,850	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		29	187.1		————>	$2,850

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $1,658
1 DISCOUNT FACTOR (From Table A–2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $24,332

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $24,332

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $940
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.12
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$1,845
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$27,182
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.84
7 SIMPLE PAYBACK (SPB)	(1F/4) =	17.56

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #9 - P503 - ENERGY EFFICIENT WINDOWS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$40,750		
B. SIOH COST	(5.5% of 1A) =	$2,241		
C. DESIGN COST	(6.0% of 1A) =	$2,445		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$45,436		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =		———————>	$45,436

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	1	$13	15.23	$194	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	54	$120	19.64	$2,356	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		55	132.7		———————>	$2,550

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $0

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $841

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$133
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$2,550
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.06
7 SIMPLE PAYBACK (SPB)	(1F/4) =	342.47

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #9 – P504 – ENERGY EFFICIENT WINDOWS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$32,969	
B. SIOH COST	(5.5% of 1A) =		$1,813	
C. DESIGN COST	(6.0% of 1A) =		$1,978	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$36,761	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =		——————>	$36,761

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	1	$18	15.23	$277	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	45	$100	19.64	$1,969	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		46	118.4		——————>	$2,246

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $0

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $741

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$118
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$2,246
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.06
7	SIMPLE PAYBACK (SPB)	(1F/4) =	310.40

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR	ADDRESS
EMC ENGINEERS INC.	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed)	PROPOSED TOTAL CONTRACT PRICE
ENERGY EFFICIENT WINDOWS – DOUBLE PANE CLEAR GLASS	

PURCHASE REQUEST NUMBER	PROJECT NUMBER	WORK LOCATION
		WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	BUILDING 100									
	WINDOW REPLACEMENT	SF	3835	12.08	46,327	0.053	35.55	7,226		$53,552.52
	DEMOLITION	SF	3835	0.16	614	0.032	28.00	3,436		$4,049.76
	TOTAL									$57,602.28
2	BUILDING 102									
	WINDOW REPLACEMENT	SF	1839	12.08	22,215	0.053	35.55	3,465		$25,680.07
	DEMOLITION	SF	1839	0.16	294	0.032	28.00	1,648		$1,941.98
	TOTAL									$27,622.06
3	BUILDING 124									
	WINDOW REPLACEMENT	SF	6797	12.08	82,108	0.053	35.55	12,807		$94,914.33
	DEMOLITION	SF	6797	0.16	1,088	0.032	28.00	6,090		$7,177.63
	TOTAL									$102,091.96
4	BUILDING 128									
	WINDOW REPLACEMENT	SF	4806	12.08	58,056	0.053	35.55	9,055		$67,111.70
	DEMOLITION	SF	4806	0.16	769	0.032	28.00	4,306		$5,075.14
	TOTAL									$72,186.84

Sour[illegible]ns Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & pro[illegible]r rates include overhead & profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): ENERGY EFFICIENT WINDOWS – DOUBLE PANE CLEAR GLASS	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER / PROJECT NUMBER	WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
5	BUILDING 129									
	WINDOW REPLACEMENT	SF	2521	12.08	30,454	0.053	35.55	4,750		$35,203.62
	DEMOLITION	SF	2521	0.16	403	0.032	28.00	2,259		$2,662.18
	TOTAL									$37,865.80
6	BUILDING 143									
	WINDOW REPLACEMENT	SF	2521	12.08	30,454	0.053	35.55	4,750		$35,203.62
	DEMOLITION	SF	2521	0.16	403	0.032	28.00	2,259		$2,662.18
	TOTAL									$37,865.80
7	BUILDING 501									
	WINDOW REPLACEMENT	SF	4725	12.08	57,078	0.053	35.55	8,903		$65,980.61
	DEMOLITION	SF	4725	0.16	756	0.032	28.00	4,234		$4,989.60
	TOTAL									$70,970.21
8	BUILDING 502									
	WINDOW REPLACEMENT	SF	1900	12.08	22,952	0.053	35.55	3,580		$26,531.89
	DEMOLITION	SF	1900	0.16	304	0.032	28.00	1,702		$2,006.40
	TOTAL									$28,538.29

Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & profit; labor rates include overhead & profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ENERGY EFFICIENT WINDOWS - DOUBLE PANE GREY GLASS

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	BUILDING 501A									
	WINDOW REPLACEMENT	SF	2771	13.29	36,827	0.053	22.24	3,266		$40,092.82
	DEMOLITION	SF	2771	0.16	443	0.032	20.58	1,825		$2,268.23
	TOTAL									$42,361.05
2	BUILDING 502									
	WINDOW REPLACEMENT	SF	1900	13.29	25,251	0.053	22.24	2,240		$27,490.57
	DEMOLITION	SF	1900	0.16	304	0.032	20.58	1,251		$1,555.26
	TOTAL									$29,045.83

So[illegible]eans Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & p[illegible]bor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 & include Ovhd & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ENERGY EFFICIENT WINDOWS – DOUBLE PANE CLEAR GLASS

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	BUILDING 501A									
	WINDOW REPLACEMENT	SF	2771	12.08	33,474	0.053	22.24	3,266		$36,739.91
	DEMOLITION	SF	2771	0.16	443	0.032	20.58	1,825		$2,268.23
	TOTAL									$39,008.14
2	BUILDING 501B									
	WINDOW REPLACEMENT	SF	1954	12.08	23,604	0.053	22.24	2,303		$25,907.54
	DEMOLITION	SF	1954	0.16	313	0.032	20.58	1,287		$1,599.47
	TOTAL									$27,507.01
3	BUILDING 502									
	WINDOW REPLACEMENT	SF	1900	12.08	22,952	0.053	22.24	2,240		$25,191.57
	DEMOLITION	SF	1900	0.16	304	0.032	20.58	1,251		$1,555.26
	TOTAL									$26,746.83

Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & profit; labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 & include Ovhd & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ENERGY EFFICIENT WINDOWS – DOUBLE PANE CLEAR GLASS

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
9	BUILDING 503									
	WINDOW REPLACEMENT	SF	2713	12.08	32,773	0.053	35.55	5,112		$37,884.74
	DEMOLITION	SF	2713	0.16	434	0.032	28.00	2,431		$2,864.93
	TOTAL									$40,749.67
10	BUILDING 504									
	WINDOW REPLACEMENT	SF	2195	12.08	26,516	0.053	35.55	4,136		$30,651.31
	DEMOLITION	SF	2195	0.16	351	0.032	28.00	1,967		$2,317.92
	TOTAL									$32,969.23

Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & profit; labor rates include overhead & profit

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ESOS STUDY AT WSMR - BUILDING 100
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:40: 2 1/22/92
Dataset Name: 100 .TM

Space heating thermostat : 76°F

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK *****

Peaked at Time ==> Mo/Hr: 0/ 0 * Mo/Hr: 0/ 0 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 * OADB: 0 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-96,977	-96,977	8.96
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-217,902	-217,902	20.12
Wall Cond	0	0		0	0.00	0	0.00	-406,977	-406,977	37.59
Partition	0			0	0.00	0	0.00	-4,042	-4,042	0.37
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-356,920	-356,920	32.96
Sub Total==>	0	0		0	0.00	0	0.00	-1,082,818	-1,082,818	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-1,082,818	-1,082,818	100.00

---------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
					DB	WB	HR	DB	WB	HR
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	30,722		
Part	22,258		
ExFlr	0		
Roof	15,572	0	0
Wall	22,789	3,330	15

------------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,273.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,273.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	7,168
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-41.44

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	76.1
Plenum	0.0	76.0
Return	0.0	76.0
Ret/OA	0.0	76.0
Runarnd	0.0	76.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak SZ - SINGLE ZONE

****** COOLING COIL PEAK ******						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 8/16		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					OADB: 96		OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	14,496	0		14,496	26.59	14,496	29.25	0	0	0.00
Glass Cond	5,990	0		5,990	10.99	5,990	12.09	0	0	0.00
Wall Cond	19,625	0		19,625	36.00	19,625	39.61	0	0	0.00
Partition	-1,945			-1,945	-3.57	-1,945	-3.93	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	38,166	0		38,166	70.02	38,166	77.02	0	0	0.00
Internal Loads										
Lights	28,409	0		28,409	52.12	28,409	57.33	0	0	0.00
People	4,200			4,200	7.71	2,300	4.64	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	32,609	0	0	32,609	59.83	30,709	61.97	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	656	1.20	0	0.00	0	0	0.00
Sup. Fan Heat				2,400	4.40		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	-19,324			-19,324	-35.45	-19,324	-39.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	51,451	0	0	54,506	100.00	49,551	100.00	0	0	0.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	5.0	60.0	58.2	2,250	78.4	59.3	57.2	53.9	48.9	51.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	3,784		
Part	838		
ExFlr	0		
Roof	0	0	0
Wall	2,884	302	10

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,250	0.6	53.9
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	56	0
Infil	0	0
Supply	2,250	0
Mincfm	0	0
Return	2,250	0
Exhaust	56	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	2.5
Clg Cfm/Sqft	0.59
Clg Cfm/Ton	450.00
Clg Sqft/Ton	756.70
Clg Btuh/Sqft	15.86
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	78.4	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 3 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	8,911	0		8,911	8.05	8,911	9.20	0	0	0.00
Glass Solar	5,670	0		5,670	5.12	5,670	5.85	0	0	0.00
Glass Cond	4,432	0		4,432	4.00	4,432	4.57	0	0	0.00
Wall Cond	28,945	0		28,945	26.15	28,945	29.87	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	47,958	0		47,958	43.33	47,958	49.49	0	0	0.00
Internal Loads										
Lights	19,694	0		19,694	17.79	19,694	20.32	0	0	0.00
People	5,040			5,040	4.55	2,760	2.85	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	24,734	0	0	24,734	22.35	22,454	23.17	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	9,930	8.97	0	0.00	0	0	0.00
Sup. Fan Heat				1,564	1.41		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	26,487			26,487	23.93	26,487	27.33	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	99,180	0	0	110,674	100.00	96,900	100.00	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F (DB)	Entering Deg F (WB)	Entering Grains	Leaving Deg F (DB)	Leaving Deg F (WB)	Leaving Grains
Main Clg	11.0	132.0	130.9	4,400	80.8	59.0	52.0	54.8	47.1	43.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	11.0	132.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	2,623		
Part	0		
ExFlr	0		
Roof	1,958	0	0
Wall	2,736	203	7

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	4,400	3.3	54.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	612	0
Infil	0	0
Supply	4,400	0
Mincfm	0	0
Return	4,400	0
Exhaust	612	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	13.9
Clg Cfm/Sqft	1.68
Clg Cfm/Ton	400.00
Clg Sqft/Ton	238.45
Clg Btuh/Sqft	50.33
No. People	12
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	55.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	80.7	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE - BUILDING 100

--------------------------------- B U I L D I N G U - V A L U E S ---------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	BLDG 100 1ST FLR	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.3	11.06
2	BLDG 100 2ND FLR	0.388	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	111.1	23.12
Zone	1 Total/Ave.	0.388	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	86.5	17.81
3	BSMT & 1ST FL SZ	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
Zone	2 Total/Ave.	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
4	1 & 2 FLR - PTAC	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
Zone	3 Total/Ave.	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
System	1 Total/Ave.	0.385	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	84.4	17.34
3	BSMT & 1ST FL SZ	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
Zone	2 Total/Ave.	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
System	2 Total/Ave.	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
4	1 & 2 FLR - PTAC	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
Zone	3 Total/Ave.	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
System	3 Total/Ave.	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
Building		0.382	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	83.1	17.04

BUILDING AREAS - ALTERNATIVE 1
BASELINE - BUILDING 100

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	BLDG 100 1ST FLR	1	1	10,702	10,702	10,710	0	0	0	0	1,275	19	5,572
2	BLDG 100 2ND FLR	1	1	13,614	13,614	10,710	0	0	0	13,614	1,550	15	8,772
Zone	1 Total/Ave.				24,316	21,420	0	0	0	13,614	2,825	16	14,343
3	BSMT & 1ST FL SZ	1	1	3,784	3,784	838	0	0	0	0	302	10	2,582
Zone	2 Total/Ave.				3,784	838	0	0	0	0	302	10	2,582
4	1 & 2 FLR - PTAC	1	1	2,623	2,623	0	0	0	0	1,958	203	7	2,534
Zone	3 Total/Ave.				2,623	0	0	0	0	1,958	203	7	2,534
System	1 Total/Ave.				30,722	22,258	0	0	0	15,572	3,330	15	19,459
3	BSMT & 1ST FL SZ	1	1	3,784	3,784	838	0	0	0	0	302	10	2,582
Zone	2 Total/Ave.				3,784	838	0	0	0	0	302	10	2,582
System	2 Total/Ave.				3,784	838	0	0	0	0	302	10	2,582
4	1 & 2 FLR - PTAC	1	1	2,623	2,623	0	0	0	0	1,958	203	7	2,534
Zone	3 Total/Ave.				2,623	0	0	0	0	1,958	203	7	2,534
System	3 Total/Ave.				2,623	0	0	0	0	1,958	203	7	2,534
Building					37,128	23,096	0	0	0	17,530	3,835	13	24,574

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.8	11	378	-63,650	12	459	332.5	0	0	0.0	0	0
5 - 10	1.6	11	364	-127,300	9	326	665.0	0	0	0.0	0	0
10 - 15	2.4	9	291	-190,950	9	334	997.5	0	0	0.0	0	0
15 - 20	3.2	8	287	-254,600	12	439	1,330.0	0	0	0.0	0	0
20 - 25	4.0	7	247	-318,250	13	469	1,662.5	0	0	0.0	0	0
25 - 30	4.8	8	282	-381,900	11	420	1,995.0	0	0	0.0	0	0
30 - 35	5.6	7	242	-445,550	14	518	2,327.5	1	49	0.0	0	0
35 - 40	6.4	8	287	-509,200	8	304	2,660.0	0	0	0.0	0	0
40 - 45	7.2	8	262	-572,850	6	240	2,992.5	0	0	0.0	0	0
45 - 50	8.0	9	291	-636,500	6	208	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	150	-700,150	0	10	3,657.5	0	0	0.0	0	0
55 - 60	9.6	3	108	-763,800	0	0	3,990.0	0	0	0.0	0	0
60 - 65	10.4	4	151	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	2	63	-891,100	0	0	4,655.0	12	436	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	0
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	0
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 95	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	86	3,079	0.0	0	0
Hours Off	0.0	0	5,357	0	0	5,033	0.0	0	5,196	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	19,290	87	4,680	13
Feb	17,443	87	3,811	13
March	20,477	87	2,163	8
April	17,744	112	291	5
May	29,045	143	0	0
June	37,700	146	0	0
July	39,990	146	0	0
Aug	39,532	146	0	0
Sept	28,311	141	0	0
Oct	20,985	138	85	3
Nov	17,973	87	2,087	9
Dec	18,694	87	3,722	11
Total	307,184	146	16,839	13

Building Energy Consumption = 88,938 (Btu/Sq Ft/Year)   Floor Area = 30,722 (Sq Ft)
Source Energy Consumption = 90,633 (Btu/Sq Ft/Year)

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**                                                                         **
**                 T R A C E    6 0 0    A N A L Y S I S                   **
**                                                                         **
**                 by            **
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ESOS STUDY AT WSMR - BUILDING 100
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) ECO #9

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:23:13 1/27/92
Dataset Name: 100 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

						*			*			
Peaked at Time ==>		Mo/Hr: 0/ 0				*	Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				*	OADB: 0		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-96,977	-96,977	11.15
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-55,125	-55,125	6.34
Wall Cond	0	0		0	0.00	*	0	0.00	*	-406,977	-406,977	46.78
Partition	0			0	0.00	*	0	0.00	*	-4,042	-4,042	0.46
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	-306,951	-306,951	35.28
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-870,073	-870,073	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-870,073	-870,073	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	30,722		
Part	22,258		
ExFlr	0		
Roof	15,572	0	0
Wall	22,789	3,330	15

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,273.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,273.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	6,165
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-41.44

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	76.1
Plenum	0.0	76.0
Return	0.0	76.0
Ret/OA	0.0	76.0
Runarnd	0.0	76.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak SZ - SINGLE ZONE

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 8/16		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					OADB: 96		OADB: 0		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	15,100	0		15,100	27.79	15,100	30.47	0	0	0.00
Glass Cond	1,629	0		1,629	3.00	1,629	3.29	0	0	0.00
Wall Cond	19,625	0		19,625	36.12	19,625	39.61	0	0	0.00
Partition	-1,945			-1,945	-3.58	-1,945	-3.93	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	34,408	0		34,408	63.33	34,408	69.44	0	0	0.00
Internal Loads										
Lights	28,409	0		28,409	52.29	28,409	57.33	0	0	0.00
People	4,200			4,200	7.73	2,300	4.64	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	32,609	0	0	32,609	60.02	30,709	61.97	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	483	0.89	0	0.00	0	0	0.00
Sup. Fan Heat				2,400	4.42		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	-15,566			-15,566	-28.65	-15,566	-31.42	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	51,451	0	0	54,334	100.00	49,551	100.00	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	5.0	60.0	58.1	2,250	78.3	59.3	57.5	53.9	48.9	52.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	3,784		
Part	838		
ExFlr	0		
Roof	0	0	0
Wall	2,884	302	10

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,250	0.4	53.9
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	41	0
Infil	0	0
Supply	2,250	0
Mincfm	0	0
Return	2,250	0
Exhaust	41	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	1.8
Clg Cfm/Sqft	0.59
Clg Cfm/Ton	450.00
Clg Sqft/Ton	756.70
Clg Btuh/Sqft	15.86
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	55.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	78.3	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 3 Peak PTAC - PACKAGED TERMINAL AIR COND.

	************************* COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					*	Mo/Hr: 7/16		*	Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					*	OADB: 97		*	OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	8,911	0		8,911	8.11	*	8,911	9.20	*	0	0	0.00
Glass Solar	5,872	0		5,872	5.35	*	5,872	6.06	*	0	0	0.00
Glass Cond	1,205	0		1,205	1.10	*	1,205	1.24	*	0	0	0.00
Wall Cond	28,945	0		28,945	26.35	*	28,945	29.87	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	44,934	0		44,934	40.90	*	44,934	46.37	*	0	0	0.00
Internal Loads						*			*			
Lights	19,694	0		19,694	17.93	*	19,694	20.32	*	0	0	0.00
People	5,040			5,040	4.59	*	2,760	2.85	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	24,734	0	0	24,734	22.52	*	22,454	23.17	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	9,112	8.29	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				1,564	1.42	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	29,511			29,511	26.86	*	29,511	30.46	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	99,180	0	0	109,856	100.00	*	96,900	100.00	*	0	0	0.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	11.0	132.0	131.0	4,400	80.7	59.0	52.4	54.8	47.1	43.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	11.0	132.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	2,623		
Part	0		
ExFlr	0		
Roof	1,958	0	0
Wall	2,736	203	7

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	4,400	3.1	54.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	569	0
Infil	0	0
Supply	4,400	0
Mincfm	0	0
Return	4,400	0
Exhaust	569	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	12.9
Clg Cfm/Sqft	1.68
Clg Cfm/Ton	400.00
Clg Sqft/Ton	238.45
Clg Btuh/Sqft	50.33
No. People	12
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	80.5	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.8	12	427	-63,650	16	566	332.5	0	0	0.0	0	0
5 - 10	1.6	11	378	-127,300	9	339	665.0	0	0	0.0	0	0
10 - 15	2.4	10	358	-190,950	11	386	997.5	0	0	0.0	0	0
15 - 20	3.2	8	283	-254,600	12	428	1,330.0	0	0	0.0	0	0
20 - 25	4.0	8	290	-318,250	11	391	1,662.5	0	0	0.0	0	0
25 - 30	4.8	8	286	-381,900	14	512	1,995.0	0	0	0.0	0	0
30 - 35	5.6	9	313	-445,550	11	400	2,327.5	2	71	0.0	0	0
35 - 40	6.4	10	350	-509,200	9	333	2,660.0	0	0	0.0	0	0
40 - 45	7.2	8	302	-572,850	6	227	2,992.5	0	0	0.0	0	0
45 - 50	8.0	5	182	-636,500	1	41	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	146	-700,150	0	0	3,657.5	0	0	0.0	0	0
55 - 60	9.6	4	130	-763,800	0	0	3,990.0	0	0	0.0	0	0
60 - 65	10.4	3	109	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	1	40	-891,100	0	0	4,655.0	10	347	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	0
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	0
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 95	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	89	3,225	-0.0	0	0
Hours Off	0.0	0	5,166	0	0	5,137	0.0	0	5,117	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	19,290	87	4,269	11
Feb	17,443	87	3,451	10
March	20,380	87	1,688	7
April	17,861	112	208	4
May	29,101	142	0	0
June	38,368	146	0	0
July	39,639	146	0	0
Aug	40,216	146	0	0
Sept	29,453	141	0	0
Oct	21,281	139	45	2
Nov	18,469	87	1,809	7
Dec	18,693	87	3,384	9
Total	310,194	146	14,854	11

Building Energy Consumption = 82,811 (Btu/Sq Ft/Year) Floor Area = 30,722 (Sq Ft)
Source Energy Consumption = 84,306 (Btu/Sq Ft/Year)

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**                                                                            **
**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by            **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 100
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT~~2~~3-ECO (GREY), ECO#9

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16: 4:13 1/27/92
Dataset Name: 100 .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ***

	Cooling Coil Peak	Clg Space Peak	Heating Coil Peak
Peaked at Time ==>	Mo/Hr: 0/ 0	Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-96,977	-96,977	11.13
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-56,103	-56,103	6.44
Wall Cond	0	0		0	0.00	0	0.00	-406,977	-406,977	46.72
Partition	0			0	0.00	0	0.00	-4,042	-4,042	0.46
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-306,951	-306,951	35.24
Sub Total==>	0	0		0	0.00	0	0.00	-871,051	-871,051	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-871,051	-871,051	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	30,722		
Part	22,258		
ExFlr	0		
Roof	15,572	0	0
Wall	22,789	3,330	15

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,273.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,273.0			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	0	6,165
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-41.44

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	76.1
Plenum	0.0	76.0
Return	0.0	76.0
Ret/OA	0.0	76.0
Runarnd	0.0	76.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak SZ - SINGLE ZONE

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 8/16			Mo/Hr: 0/ 0	
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					OADB: 96			OADB: 0	

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	9,664	0		9,664	17.79	9,664	19.50	0	0	0.00
Glass Cond	1,667	0		1,667	3.07	1,667	3.37	0	0	0.00
Wall Cond	19,625	0		19,625	36.12	19,625	39.61	0	0	0.00
Partition	-1,945			-1,945	-3.58	-1,945	-3.93	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	29,011	0		29,011	53.40	29,011	58.55	0	0	0.00
Internal Loads										
Lights	28,409	0		28,409	52.29	28,409	57.33	0	0	0.00
People	4,200			4,200	7.73	2,300	4.64	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	32,609	0	0	32,609	60.02	30,709	61.97	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	477	0.88	0	0.00	0	0	0.00
Sup. Fan Heat				2,400	4.42		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	-10,169			-10,169	-18.72	-10,169	-20.52	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	51,451	0	0	54,327	100.00	49,551	100.00	0	0	0.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	5.0	60.0	58.1	2,250	78.3	59.4	57.7	53.9	49.0	52.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	3,784		
Part	838		
ExFlr	0		
Roof	0	0	0
Wall	2,884	302	10

-----------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,250	0.4	53.9
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	41	0
Infil	0	0
Supply	2,250	0
Mincfm	0	0
Return	2,250	0
Exhaust	41	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	1.8
Clg Cfm/Sqft	0.59
Clg Cfm/Ton	450.00
Clg Sqft/Ton	756.70
Clg Btuh/Sqft	15.86
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	78.3	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 3 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					*	Mo/Hr: 7/16		*	Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					*	OADB: 97		*	OADB: 0		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	8,911	0		8,911	8.11	*	8,911	9.20	*	0	0	0.00
Glass Solar	3,645	0		3,645	3.32	*	3,645	3.76	*	0	0	0.00
Glass Cond	1,227	0		1,227	1.12	*	1,227	1.27	*	0	0	0.00
Wall Cond	28,945	0		28,945	26.35	*	28,945	29.87	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	42,728	0		42,728	38.89	*	42,728	44.09	*	0	0	0.00
Internal Loads						*			*			
Lights	19,694	0		19,694	17.93	*	19,694	20.32	*	0	0	0.00
People	5,040			5,040	4.59	*	2,760	2.85	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	24,734	0	0	24,734	22.52	*	22,454	23.17	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	9,112	8.29	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				1,564	1.42	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	31,718			31,718	28.87	*	31,718	32.73	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	99,180	0	0	109,856	100.00	*	96,900	100.00	*	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	11.0	132.0	131.0	4,400	80.7	59.0	52.4	54.8	47.1	43.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	11.0	132.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	2,623		
Part	0		
ExFlr	0		
Roof	1,958	0	0
Wall	2,736	203	7

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	4,400	3.1	54.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	569	0
Infil	0	0
Supply	4,400	0
Mincfm	0	0
Return	4,400	0
Exhaust	569	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	12.9
Clg Cfm/Sqft	1.68
Clg Cfm/Ton	400.00
Clg Sqft/Ton	238.45
Clg Btuh/Sqft	50.33
No. People	12
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	55.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	80.5	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

--------------------------------------- S Y S T E M   L O A D   P R O F I L E ---------------------------------------

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.8	13	450	-63,650	13	494	332.5	0	0	0.0	0	0
5 - 10	1.6	10	363	-127,300	10	371	665.0	0	0	0.0	0	0
10 - 15	2.4	10	363	-190,950	10	358	997.5	0	0	0.0	0	0
15 - 20	3.2	9	305	-254,600	14	502	1,330.0	0	0	0.0	0	0
20 - 25	4.0	7	251	-318,250	10	371	1,662.5	0	0	0.0	0	0
25 - 30	4.8	10	341	-381,900	14	530	1,995.0	0	0	0.0	0	0
30 - 35	5.6	7	256	-445,550	12	438	2,327.5	2	76	0.0	0	0
35 - 40	6.4	9	336	-509,200	9	344	2,660.0	0	0	0.0	0	0
40 - 45	7.2	10	343	-572,850	6	207	2,992.5	0	0	0.0	0	0
45 - 50	8.0	5	175	-636,500	2	70	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	147	-700,150	0	0	3,657.5	0	0	0.0	0	0
55 - 60	9.6	3	108	-763,800	0	0	3,990.0	0	0	0.0	0	0
60 - 65	10.4	2	86	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	1	20	-891,100	0	0	4,655.0	9	318	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	0
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	0
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 95	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	89	3,191	0.0	0	0
Hours Off	0.0	0	5,216	0	0	5,075	0.0	0	5,175	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	19,290	87	4,343	11
Feb	17,443	87	3,529	10
March	20,475	87	1,862	7
April	17,698	112	263	4
May	28,724	142	0	0
June	37,991	146	0	0
July	39,229	146	0	0
Aug	39,830	146	0	0
Sept	28,877	141	0	0
Oct	21,270	138	71	2
Nov	18,470	87	1,926	7
Dec	18,694	87	3,458	9
Total	307,991	146	15,451	11

Building Energy Consumption = 84,509 (Btu/Sq Ft/Year)   Floor Area = 30,722 (Sq Ft)
Source Energy Consumption = 86,065 (Btu/Sq Ft/Year)

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**                  T R A C E   6 0 0   A N A L Y S I S                     **
**                                                                          **
**                  by             **
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ESOS STUDY AT WSMR - BUILDING 102
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO ECO #9

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:50:22 1/22/92
Dataset Name: 102 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK *****

Peaked at Time ==>		Mo/Hr: 0/ 0				Mo/Hr: 0/ 0		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				OADB: 0		OADB: 24	

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-56,792	-56,792	12.76
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-101,879	-101,879	22.89
Wall Cond	0	0		0	0.00	0	0.00	-139,347	-139,347	31.31
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-15,361	-15,361	3.45
Infiltration	0			0	0.00	0	0.00	-131,670	-131,670	29.59
Sub Total==>	0	0		0	0.00	0	0.00	-445,049	-445,049	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-445,049	-445,049	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	20,327		
Part	12,765		
ExFlr	465		
Roof	10,163	0	0
Wall	14,020	1,839	13

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-482.5	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-482.5			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	0	3,125
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-23.74

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					*	Mo/Hr: 8/16		*	Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					*	OADB: 96		*	OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	4,691	0		4,691	16.54	*	4,222	16.33	*	0	0	0.00
Glass Solar	2,927	0		2,927	10.32	*	3,057	11.83	*	0	0	0.00
Glass Cond	1,424	0		1,424	5.02	*	1,290	4.99	*	0	0	0.00
Wall Cond	8,918	0		8,918	31.45	*	9,492	36.73	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	17,960	0		17,960	63.34	*	18,061	69.88	*	0	0	0.00
Internal Loads						*			*			
Lights	6,635	0		6,635	23.40	*	6,635	25.67	*	0	0	0.00
People	2,100			2,100	7.41	*	1,150	4.45	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	8,735	0	0	8,735	30.81	*	7,785	30.12	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	1,305	4.60	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				356	1.25	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	26,694	0	0	28,355	100.00	*	25,846	100.00	*	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	2.5	30.0	29.1	1,000	79.7	58.5	51.4	50.8	46.4	47.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.5	30.0								

AREAS

Gross Total		Glass (sf)	(%)
Floor	972		
Part	540		
ExFlr	0		
Roof	972	0	0
Wall	1,068	65	6

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,000	1.9	50.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	78	0
Infil	0	0
Supply	1,000	0
Mincfm	0	0
Return	1,000	0
Exhaust	78	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	7.8
Clg Cfm/Sqft	1.03
Clg Cfm/Ton	400.00
Clg Sqft/Ton	388.80
Clg Btuh/Sqft	30.86
No. People	5
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	51.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.5	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 1
BASELINE BUILDING 102

------------- P S Y C H R O M E T R I C   S T A T E   P O I N T S --------------

Room 3

	Dry Bulb (F)	Wet Bulb (F)	Relat. Humid. (%)	Humid. Ratio (GR)	Enthalpy (Btu/Lb)	Temp. Diff. (F)
Space	78.0	58.0	31.1	51.6	26.8	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.0	31.1	51.6	26.8	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.5	58.4	29.5	51.4	27.1	
Blow through Fan						0.2
Entering Coil	79.7	58.5	29.3	51.4	27.2	
Leaving Coil	50.8	47.3	79.0	50.6	20.0	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	51.0	47.4	78.4	50.6	20.1	
Supply Air	51.0	47.4	78.4	50.6	20.1	

Percent Outside Air 7.78 (%)
Sensible Heat Ratio (SHR) 0.965
Percent Supply Air Bypassing Coil 0.00 (%)
Coil Airflow 1,000 (Cfm)

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 102

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.260	0.000	40.9	8.18
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	85.7	18.04
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.127	1.140	1.259	0.260	0.000	62.2	12.86
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.127	1.140	1.259	0.260	0.000	64.0	13.26
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
System	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
Building		0.388	0.750	0.000	0.000	0.127	1.140	1.259	0.260	0.000	65.7	13.62

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 102

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	10,164	10,164	8,001	465	0	0	0	890	12	6,301
2	2ND FLOOR	1	1	9,191	9,191	4,224	0	0	0	9,191	884	15	4,876
Zone	1 Total/Ave.				19,355	12,225	465	0	0	9,191	1,774	14	11,178
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	1 Total/Ave.				20,327	12,765	465	0	0	10,163	1,839	13	12,181
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
Building					21,299	13,305	465	0	0	11,135	1,904	13	13,184

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.1	8	235	-24,125	13	240	50.0	0	0	0.0	0	0
5 - 10	0.3	7	202	-48,250	16	286	100.0	0	0	0.0	0	0
10 - 15	0.4	8	256	-72,375	13	238	150.0	0	0	0.0	0	0
15 - 20	0.5	6	191	-96,500	13	229	200.0	0	0	0.0	0	0
20 - 25	0.6	6	185	-120,625	6	114	250.0	0	0	0.0	0	0
25 - 30	0.8	6	179	-144,750	6	113	300.0	0	0	0.0	0	0
30 - 35	0.9	4	121	-168,875	6	113	350.0	0	0	0.0	0	0
35 - 40	1.0	8	257	-193,000	11	200	400.0	0	0	0.0	0	0
40 - 45	1.1	8	261	-217,125	8	146	450.0	0	0	0.0	0	0
45 - 50	1.3	6	183	-241,250	6	111	500.0	0	0	0.0	0	0
50 - 55	1.4	9	276	-265,375	1	10	550.0	0	0	0.0	0	0
55 - 60	1.5	5	144	-289,500	0	0	600.0	0	0	0.0	0	0
60 - 65	1.6	8	262	-313,625	0	0	650.0	0	0	0.0	0	0
65 - 70	1.8	4	139	-337,750	0	0	700.0	0	0	0.0	0	0
70 - 75	1.9	3	108	-361,875	0	0	750.0	0	0	0.0	0	0
75 - 80	2.0	2	48	-386,000	0	0	800.0	0	0	0.0	0	0
80 - 85	2.1	1	43	-410,125	0	0	850.0	0	0	0.0	0	0
85 - 90	2.3	0	0	-434,250	0	0	900.0	0	0	0.0	0	0
90 - 95	2.4	0	0	-458,375	0	0	950.0	0	0	0.0	0	0
95 - 100	2.5	0	0	-482,500	0	0	1,000.0	100	3,159	0.0	0	0
Hours Off	0.0	0	5,670	0	0	6,960	0.0	0	5,601	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	8,375	43	1,133	5
Feb	7,510	43	735	5
March	8,763	43	63	3
April	7,901	43	0	0
May	9,224	47	0	0
June	9,712	47	0	0
July	9,445	47	0	0
Aug	10,270	47	0	0
Sept	8,619	47	0	0
Oct	8,670	47	0	0
Nov	7,823	43	151	2
Dec	8,014	43	773	4
Total	104,326	47	2,855	5

Building Energy Consumption = 31,563 (Btu/Sq Ft/Year)   Floor Area = 20,328 (Sq Ft)
Source Energy Consumption = 31,997 (Btu/Sq Ft/Year)

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**                                                                        **
**              T R A C E   6 0 0   A N A L Y S I S                       **
**                                                                        **
**              by            **
**                                                                        **
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ESOS STUDY AT WSMR - BUILDING 102
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO <CLEAR>

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 2:41:45 1/24/92
Dataset Name: 102 .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ****

						*			*			
Peaked at Time ==>		Mo/Hr: 0/ 0				*	Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				*	OADB: 0		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-56,792	-56,792	15.79
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-25,766	-25,766	7.16
Wall Cond	0	0		0	0.00	*	0	0.00	*	-139,347	-139,347	38.74
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-15,361	-15,361	4.27
Infiltration	0			0	0.00	*	0	0.00	*	-122,453	-122,453	34.04
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-359,719	-359,719	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-359,719	-359,719	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

Gross Total		Glass (sf)	(%)
Floor	20,327		
Part	12,765		
ExFlr	465		
Roof	10,163	0	0
Wall	14,020	1,839	13

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-482.5	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-482.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	2,907
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-23.74

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 8/16		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 96		OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	4,691	0		4,691	17.14	4,222	16.86	0	0	0.00
Glass Solar	3,057	0		3,057	11.17	3,187	12.73	0	0	0.00
Glass Cond	385	0		385	1.41	351	1.40	0	0	0.00
Wall Cond	8,918	0		8,918	32.59	9,492	37.91	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	17,051	0		17,051	62.30	17,252	68.91	0	0	0.00
Internal Loads										
Lights	6,635	0		6,635	24.24	6,635	26.50	0	0	0.00
People	2,100			2,100	7.67	1,150	4.59	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	8,735	0	0	8,735	31.92	7,785	31.09	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	1,227	4.48	0	0.00	0	0	0.00
Sup. Fan Heat				356	1.30		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	25,786	0	0	27,369	100.00	25,036	100.00	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F (WB)	Entering Grains	Leaving Deg F	Leaving Deg F (WB)	Leaving Grains
Main Clg	2.5	30.0	29.2	1,000	79.7	58.8	52.9	51.6	46.8	47.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.5	30.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	972		
Part	540		
ExFlr	0		
Roof	972	0	0
Wall	1,068	65	6

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,000	1.9	51.5
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	78	0
Infil	0	0
Supply	1,000	0
Mincfm	0	0
Return	1,000	0
Exhaust	78	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	7.8
Clg Cfm/Sqft	1.03
Clg Cfm/Ton	400.00
Clg Sqft/Ton	388.80
Clg Btuh/Sqft	30.86
No. People	5
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	51.9	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.5	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 2
BASELINE BUILDING 102

------------- P S Y C H R O M E T R I C S T A T E P O I N T S --------------

Room 3

	Dry Bulb (F)	Wet Bulb (F)	Relat. Humid. (%)	Humid. Ratio (GR)	Enthalpy (Btu/Lb)	Temp. Diff. (F)
Space	78.0	58.3	32.0	53.2	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.3	32.0	53.2	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.5	58.8	30.3	52.9	27.4	
Blow through Fan						0.2
Entering Coil	79.7	58.8	30.1	52.9	27.4	
Leaving Coil	51.6	48.1	78.9	52.2	20.5	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	51.9	48.1	78.3	52.2	20.5	
Supply Air	51.9	48.1	78.3	52.2	20.5	

Percent Outside Air 7.78 (%)
Sensible Heat Ratio (SHR) 0.963
Percent Supply Air Bypassing Coil 0.00 (%)
Coil Airflow 1,000 (Cfm)

BUILDING U-VALUES - ALTERNATIVE 2
BASELINE BUILDING 102

-------------------------------- B U I L D I N G U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.260	0.000	40.9	8.18
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	85.7	18.04
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.127	0.310	0.318	0.260	0.000	62.2	12.86
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.127	0.310	0.318	0.260	0.000	64.0	13.26
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
System	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
Building		0.388	0.750	0.000	0.000	0.127	0.310	0.318	0.260	0.000	65.7	13.62

BUILDING AREAS - ALTERNATIVE 2
BASELINE BUILDING 102

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	10,164	10,164	8,001	465	0	0	0	890	12	6,301
2	2ND FLOOR	1	1	9,191	9,191	4,224	0	0	0	9,191	884	15	4,876
Zone	1 Total/Ave.				19,355	12,225	465	0	0	9,191	1,774	14	11,178
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	1 Total/Ave.				20,327	12,765	465	0	0	10,163	1,839	13	12,181
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
Building					21,299	13,305	465	0	0	11,135	1,904	13	13,184

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.1	9	280	-24,125	16	261	50.0	0	0	0.0	0	0
5 - 10	0.3	8	257	-48,250	13	218	100.0	0	0	0.0	0	0
10 - 15	0.4	7	234	-72,375	17	283	150.0	0	0	0.0	0	0
15 - 20	0.5	7	225	-96,500	13	224	200.0	0	0	0.0	0	0
20 - 25	0.6	6	193	-120,625	10	169	250.0	0	0	0.0	0	0
25 - 30	0.8	6	203	-144,750	6	97	300.0	0	0	0.0	0	0
30 - 35	0.9	4	120	-168,875	7	115	350.0	0	0	0.0	0	0
35 - 40	1.0	8	271	-193,000	8	134	400.0	0	0	0.0	0	0
40 - 45	1.1	6	201	-217,125	8	138	450.0	0	0	0.0	0	0
45 - 50	1.3	9	274	-241,250	2	41	500.0	0	0	0.0	0	0
50 - 55	1.4	8	258	-265,375	0	0	550.0	0	0	0.0	0	0
55 - 60	1.5	6	191	-289,500	0	0	600.0	0	0	0.0	0	0
60 - 65	1.6	6	208	-313,625	0	0	650.0	0	0	0.0	0	0
65 - 70	1.8	5	156	-337,750	0	0	700.0	0	0	0.0	0	0
70 - 75	1.9	3	106	-361,875	0	0	750.0	0	0	0.0	0	0
75 - 80	2.0	0	0	-386,000	0	0	800.0	0	0	0.0	0	0
80 - 85	2.1	1	43	-410,125	0	0	850.0	0	0	0.0	0	0
85 - 90	2.3	0	0	-434,250	0	0	900.0	0	0	0.0	0	0
90 - 95	2.4	0	0	-458,375	0	0	950.0	0	0	0.0	0	0
95 - 100	2.5	0	0	-482,500	0	0	1,000.0	100	3,256	0.0	0	0
Hours Off	0.0	0	5,540	0	0	7,080	0.0	0	5,504	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	8,366	43	1,003	4
Feb	7,489	43	595	4
March	8,758	43	46	2
April	7,911	46	0	0
May	9,227	47	0	0
June	9,694	47	0	0
July	9,411	47	0	0
Aug	10,254	47	0	0
Sept	8,646	47	0	0
Oct	8,675	47	0	0
Nov	7,806	43	124	2
Dec	7,990	43	657	3
Total	104,227	47	2,427	4

Building Energy Consumption = 29,437 (Btu/Sq Ft/Year)   Floor Area = 20,328 (Sq Ft)
Source Energy Consumption = 29,806 (Btu/Sq Ft/Year)

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**              T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                         **
**              by          **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 124
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 8: 8:22 1/23/92
Dataset Name: 124 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

	Cooling Coil Peak	CLG Space Peak	Heating Coil Peak
Peaked at Time ==>	Mo/Hr: 0/ 0	Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-70,104	-70,104	6.36
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-416,467	-416,467	37.79
Wall Cond	0	0		0	0.00	0	0.00	-222,355	-222,355	20.18
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-392,993	-392,993	35.66
Sub Total==>	0	0		0	0.00	0	0.00	-1,101,919	-1,101,919	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-1,101,919	-1,101,919	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	40,046		
Part	18,194		
ExFlr	0		
Roof	13,348	0	0
Wall	22,202	6,365	29

-----------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,798.4	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,798.4			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	7,893
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-44.91

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	76.1
Plenum	0.0	76.0
Return	0.0	76.0
Ret/OA	0.0	76.0
Runarnd	0.0	76.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

*************************** COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak					*	Clg Space Peak		*	Heating Coil Peak		
Peaked at Time ==>	Mo/Hr: 7/16					*	Mo/Hr: 7/16		*	Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					*	OADB: 97		*	OADB: 0		
	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Solar	11,664	0		11,664	22.87	*	11,664	25.38	*	0	0	0.00
Glass Cond	9,456	0		9,456	18.54	*	9,456	20.57	*	0	0	0.00
Wall Cond	6,579	0		6,579	12.90	*	6,579	14.31	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	27,698	0		27,698	54.31	*	27,698	60.27	*	0	0	0.00
Internal Loads						*			*			
Lights	10,614	0		10,614	20.81	*	10,614	23.09	*	0	0	0.00
People	2,100			2,100	4.12	*	1,150	2.50	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	12,714	0	0	12,714	24.93	*	11,764	25.60	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	3,379	6.63	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				711	1.39	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	6,497			6,497	12.74	*	6,497	14.14	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	46,910	0	0	51,000	100.00	*	45,960	100.00	*	0	0	0.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	5.0	60.0	59.5	2,000	80.2	58.9	52.3	53.8	46.9	44.4
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	1,555		
Part	0		
ExFlr	0		
Roof	0	0	0
Wall	1,321	432	33

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,000	2.5	53.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	210	0
Infil	0	0
Supply	2,000	0
Mincfm	0	0
Return	2,000	0
Exhaust	210	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.5
Clg Cfm/Sqft	1.29
Clg Cfm/Ton	400.00
Clg Sqft/Ton	311.00
Clg Btuh/Sqft	38.59
No. People	5
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	54.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	80.0	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 1
BASELINE BLDG 124

-------------- P S Y C H R O M E T R I C   S T A T E   P O I N T S --------------

Room 4

	Dry Bulb (F)	Wet Bulb (F)	Relat. Humid. (%)	Humid. Ratio (GR)	Enthalpy (Btu/Lb)	Temp. Diff. (F)
Space	78.0	58.2	31.8	52.7	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.2	31.8	52.7	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	80.0	58.8	29.5	52.3	27.4	
Blow through Fan						0.2
Entering Coil	80.2	58.9	29.3	52.3	27.4	
Leaving Coil	53.8	49.0	73.1	52.3	21.0	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	54.0	49.1	72.7	52.5	21.1	
Supply Air	54.0	49.1	72.5	52.3	21.1	

Percent Outside Air	10.50	(%)
Sensible Heat Ratio (SHR)	0.980	
Percent Supply Air Bypassing Coil	0.00	(%)
Coil Airflow	2,000	(Cfm)

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BLDG 124

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

		Room U-Values (Btu/hr/sqft/F)									Room	Room
Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Mass (lb/ sqft)	Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.270	0.000	30.5	6.09
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.270	0.000	30.3	6.05
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.101	1.140	1.259	0.270	0.000	81.8	17.26
Zone	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	1.140	1.259	0.270	0.000	48.2	9.95
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	1.140	1.259	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	1.140	1.259	0.270	0.000	29.7	5.94
System	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	1.140	1.259	0.270	0.000	47.5	9.79
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	1.140	1.259	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	1.140	1.259	0.270	0.000	29.7	5.94
System	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	1.140	1.259	0.270	0.000	29.7	5.94
Building		0.388	0.000	0.000	0.000	0.101	1.140	1.259	0.270	0.000	46.8	9.65

BUILDING AREAS - ALTERNATIVE 1
BASELINE BLDG 124

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,303	12,303	6,065	0	0	0	0	1,770	27	4,721
2	2ND FLOOR	1	1	12,840	12,840	6,065	0	0	0	0	2,041	29	4,948
3	3RD FLOOR	1	1	13,348	13,348	6,065	0	0	0	13,348	2,122	29	5,279
Zone	1 Total/Ave.				38,491	18,194	0	0	0	13,348	5,933	28	14,948
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	1 Total/Ave.				40,046	18,194	0	0	0	13,348	6,365	29	15,837
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
Building					41,601	18,194	0	0	0	13,348	6,796	29	16,726

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.3	9	198	-89,921	20	599	100.0	0	0	0.0	0	0
5 - 10	0.5	7	153	-179,842	12	376	200.0	0	0	0.0	0	0
10 - 15	0.8	11	241	-269,763	12	358	300.0	0	0	0.0	0	0
15 - 20	1.0	6	141	-359,684	10	313	400.0	0	0	0.0	0	0
20 - 25	1.3	7	170	-449,605	14	430	500.0	0	0	0.0	0	0
25 - 30	1.5	9	205	-539,526	16	496	600.0	0	0	0.0	0	0
30 - 35	1.8	10	235	-629,447	10	304	700.0	0	0	0.0	0	0
35 - 40	2.0	7	169	-719,368	4	133	800.0	0	0	0.0	0	0
40 - 45	2.3	8	185	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	9	215	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	7	166	-989,131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	3	66	-1,079,052	0	0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	3	65	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	4	86	-1,258,894	0	0	1,400.0	0	0	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 80	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	0
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	0
85 - 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	0
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	0
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,312	0.0	0	0
Hours Off	0.0	0	6,465	0	0	5,751	0.0	0	6,448	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	17,327	85	4,091	14
Feb	15,627	85	3,373	14
March	17,875	85	1,868	9
April	15,378	85	313	6
May	17,767	99	0	0
June	19,004	100	0	0
July	18,398	100	0	0
Aug	19,776	100	0	0
Sept	16,449	98	0	0
Oct	16,550	97	27	2
Nov	15,957	85	1,703	10
Dec	16,525	85	3,133	12
Total	206,633	100	14,508	14

Building Energy Consumption = 51,826 (Btu/Sq Ft/Year) Floor Area = 41,601 (Sq Ft)
Source Energy Consumption = 52,905 (Btu/Sq Ft/Year)

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**              T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                          **
**              by          **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 124
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:18: 7 1/28/92
Dataset Name: 124 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ****

Peaked at Time ==> Mo/Hr: 0/ 0 * Mo/Hr: 0/ 0 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 * OADB: 0 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-70,104	-70,104	9.18
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-105,358	-105,358	13.80
Wall Cond	0	0		0	0.00	0	0.00	-222,355	-222,355	29.13
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-365,484	-365,484	47.88
Sub Total==>	0	0		0	0.00	0	0.00	-763,300	-763,300	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-763,300	-763,300	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	40,046		
Part	18,194		
ExFlr	0		
Roof	13,348	0	0
Wall	22,202	6,365	29

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,798.4	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,798.4			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	7,340
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-44.91

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	76.1
Plenum	0.0	76.0
Return	0.0	76.0
Ret/OA	0.0	76.0
Runarnd	0.0	76.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 8/16		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 96		OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	12,096	0		12,096	23.96	12,960	28.20	0	0	0.00
Glass Cond	2,571	0		2,571	5.09	2,330	5.07	0	0	0.00
Wall Cond	6,579	0		6,579	13.03	6,219	13.53	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	21,246	0		21,246	42.09	21,509	46.80	0	0	0.00
Internal Loads										
Lights	10,614	0		10,614	21.03	10,614	23.09	0	0	0.00
People	2,100			2,100	4.16	1,150	2.50	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	12,714	0	0	12,714	25.19	11,764	25.60	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	3,120	6.18	0	0.00	0	0	0.00
Sup. Fan Heat				711	1.41		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	12,687			12,687	25.13	12,687	27.60	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	46,647	0	0	50,479	100.00	45,960	100.00	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
					DB	WB	HR	DB	WB	HR
Main Clg	5.0	60.0	59.5	2,000	80.0	58.9	52.5	53.8	46.9	44.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

AREAS

Gross Total		Glass (sf)	(%)
Floor	1,555		
Part	0		
ExFlr	0		
Roof	0	0	0
Wall	1,321	432	33

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,000	2.3	53.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	195	0
Infil	0	0
Supply	2,000	0
Mincfm	0	0
Return	2,000	0
Exhaust	195	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	9.8
Clg Cfm/Sqft	1.29
Clg Cfm/Ton	400.00
Clg Sqft/Ton	311.00
Clg Btuh/Sqft	38.59
No. People	5
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	54.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.9	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 124

-------------- P S Y C H R O M E T R I C   S T A T E   P O I N T S --------------

Room 4

	Dry Bulb (F)	Wet Bulb (F)	Relat. Humid. (%)	Humid. Ratio (GR)	Enthalpy (Btu/Lb)	Temp. Diff. (F)
Space	78.0	58.2	31.9	52.9	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.2	31.9	52.9	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.9	58.8	29.7	52.5	27.4	
Blow through Fan						0.2
Entering Coil	80.0	58.9	29.6	52.5	27.4	
Leaving Coil	53.8	49.0	73.4	52.5	21.1	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	54.0	49.2	73.0	52.7	21.1	
Supply Air	54.0	49.1	72.8	52.5	21.1	

Percent Outside Air	9.76	(%)
Sensible Heat Ratio (SHR)	0.980	
Percent Supply Air Bypassing Coil	0.00	(%)
Coil Airflow	2,000	(Cfm)

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 124

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	30.5	6.09
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	30.3	6.05
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	81.8	17.26
Zone	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	48.2	9.95
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
System	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	47.5	9.79
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
System	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
Building		0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	46.8	9.65

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 124

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,303	12,303	6,065	0	0	0	0	1,770	27	4,721
2	2ND FLOOR	1	1	12,840	12,840	6,065	0	0	0	0	2,041	29	4,948
3	3RD FLOOR	1	1	13,348	13,348	6,065	0	0	0	13,348	2,122	29	5,279
Zone	1 Total/Ave.				38,491	18,194	0	0	0	13,348	5,933	28	14,948
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	1 Total/Ave.				40,046	18,194	0	0	0	13,348	6,365	29	15,837
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
Building					41,601	18,194	0	0	0	13,348	6,796	29	16,726

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load			Heating Load			Cooling Airflow			Heating Airflow		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.3	13	324	-89,921	21	568	100.0	0	0	0.0	0	0
5 - 10	0.5	10	247	-179,842	15	398	200.0	0	0	0.0	0	0
10 - 15	0.8	9	232	-269,763	10	259	300.0	0	0	0.0	0	0
15 - 20	1.0	8	206	-359,684	17	452	400.0	0	0	0.0	0	0
20 - 25	1.3	9	242	-449,605	16	424	500.0	0	0	0.0	0	0
25 - 30	1.5	8	209	-539,526	13	331	600.0	0	0	0.0	0	0
30 - 35	1.8	11	276	-629,447	8	211	700.0	0	0	0.0	0	0
35 - 40	2.0	10	261	-719,368	0	0	800.0	0	0	0.0	0	0
40 - 45	2.3	7	183	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	4	113	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	6	167	-989,131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	3	86	-1,079,052	0	0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	2	43	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	0	0	-1,258,894	0	0	1,400.0	0	0	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 80	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	0
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	0
85 - 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	0
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	0
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,643	0.0	0	0
Hours Off	0.0	0	6,171	0	0	6,117	0.0	0	6,117	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	17,211	85	3,436	10
Feb	15,502	85	2,752	10
March	17,678	85	1,208	7
April	15,279	83	163	4
May	17,818	99	0	0
June	18,787	100	0	0
July	18,071	100	0	0
Aug	19,567	100	0	0
Sept	16,586	98	0	0
Oct	16,599	97	0	0
Nov	15,754	96	1,102	7
Dec	16,455	85	2,530	8
Total	205,305	100	11,192	10

Building Energy Consumption = 43,747 (Btu/Sq Ft/Year)

Source Energy Consumption = 44,579 (Btu/Sq Ft/Year)

Floor Area = 41,601 (Sq Ft)

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**                  T R A C E   6 0 0   A N A L Y S I S                       **
**                                                                            **
**                  by            **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 124
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT ~~2~~ 3-ECO (GREY) (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17: 6:46 1/28/92
Dataset Name: 124 .TM

System 1 Block RAD - RADIATION

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-70,104	-70,104	9.16
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-107,227	-107,227	14.01
Wall Cond	0	0		0	0.00	0	0.00	-222,355	-222,355	29.06
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-365,484	-365,484	47.77
Sub Total==>	0	0		0	0.00	0	0.00	-765,169	-765,169	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-765,169	-765,169	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	40,046		
Part	18,194		
ExFlr	0		
Roof	13,348	0	0
Wall	22,202	6,365	29

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,798.4	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,798.4			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	7,340
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-44.91

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	76.1
Plenum	0.0	76.0
Return	0.0	76.0
Ret/OA	0.0	76.0
Runarnd	0.0	76.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 0		
Envelope Loads										
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	7,776	0		7,776	15.32	7,776	16.92	0	0	0.00
Glass Cond	2,617	0		2,617	5.16	2,617	5.69	0	0	0.00
Wall Cond	6,579	0		6,579	12.97	6,579	14.31	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	16,972	0		16,972	33.45	16,972	36.93	0	0	0.00
Internal Loads										
Lights	10,614	0		10,614	20.92	10,614	23.09	0	0	0.00
People	2,100			2,100	4.14	1,150	2.50	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	12,714	0	0	12,714	25.06	11,764	25.60	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	3,120	6.15	0	0.00	0	0	0.00
Sup. Fan Heat				711	1.40		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	17,224			17,224	33.94	17,224	37.48	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	46,910	0	0	50,742	100.00	45,960	100.00	0	0	0.00

------------COOLING COIL SELECTION------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	5.0	60.0	59.5	2,000	80.0	58.9	52.5	53.8	46.9	44.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

------AREAS------

	Gross Total	Glass (sf)	(%)
Floor	1,555		
Part	0		
ExFlr	0		
Roof	0	0	0
Wall	1,321	432	33

------HEATING COIL SELECTION------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,000	2.3	53.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

------AIRFLOWS (cfm)------

Type	Cooling	Heating
Vent	195	0
Infil	0	0
Supply	2,000	0
Mincfm	0	0
Return	2,000	0
Exhaust	195	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	9.8
Clg Cfm/Sqft	1.29
Clg Cfm/Ton	400.00
Clg Sqft/Ton	311.00
Clg Btuh/Sqft	38.59
No. People	5
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)--

Type	Clg	Htg
SADB	54.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.9	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 3
EFFICIENT WINDOWS (GRAY) BLDG. 124

------------- P S Y C H R O M E T R I C   S T A T E   P O I N T S --------------

Room 4

	Dry Bulb (F)	Wet Bulb (F)	Relat. Humid. (%)	Humid. Ratio (GR)	Enthalpy (Btu/Lb)	Temp. Diff. (F)
Space	78.0	58.2	31.9	52.9	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.2	31.9	52.9	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.9	58.8	29.7	52.5	27.4	
Blow through Fan						0.2
Entering Coil	80.0	58.9	29.6	52.5	27.4	
Leaving Coil	53.8	49.0	73.4	52.5	21.1	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	54.0	49.2	73.0	52.7	21.1	
Supply Air	54.0	49.1	72.8	52.5	21.1	

Percent Outside Air	9.76	(%)
Sensible Heat Ratio (SHR)	0.980	
Percent Supply Air Bypassing Coil	0.00	(%)
Coil Airflow	2,000	(Cfm)

BUILDING U-VALUES - ALTERNATIVE 3
EFFICIENT WINDOWS (GRAY) BLDG. 124

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.000	0.000	0.000	0.000	0.315	0.324	0.270	0.000	30.5	6.09
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	0.315	0.324	0.270	0.000	30.3	6.05
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	81.8	17.26
Zone	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	48.2	9.95
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
System	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	47.5	9.79
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
System	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
Building		0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	46.8	9.65

BUILDING AREAS - ALTERNATIVE 3
EFFICIENT WINDOWS (GRAY) BLDG. 124

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,303	12,303	6,065	0	0	0	0	1,770	27	4,721
2	2ND FLOOR	1	1	12,840	12,840	6,065	0	0	0	0	2,041	29	4,948
3	3RD FLOOR	1	1	13,348	13,348	6,065	0	0	0	13,348	2,122	29	5,279
Zone	1 Total/Ave.				38,491	18,194	0	0	0	13,348	5,933	28	14,948
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	1 Total/Ave.				40,046	18,194	0	0	0	13,348	6,365	29	15,837
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
Building					41,601	18,194	0	0	0	13,348	6,796	29	16,726

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.3	13	338	-89,921	18	523	100.0	0	0	0.0	0	0
5 - 10	0.5	8	208	-179,842	14	413	200.0	0	0	0.0	0	0
10 - 15	0.8	10	254	-269,763	13	382	300.0	0	0	0.0	0	0
15 - 20	1.0	8	213	-359,684	14	402	400.0	0	0	0.0	0	0
20 - 25	1.3	9	226	-449,605	18	527	500.0	0	0	0.0	0	0
25 - 30	1.5	12	313	-539,526	13	370	600.0	0	0	0.0	0	0
30 - 35	1.8	11	281	-629,447	8	239	700.0	0	0	0.0	0	0
35 - 40	2.0	9	234	-719,368	0	0	800.0	0	0	0.0	0	0
40 - 45	2.3	6	155	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	7	169	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	4	109	-989,131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	1	20	-1,079,052	0	0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	0	0	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	0	0	-1,258,894	0	0	1,400.0	0	0	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 80	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	0
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	0
85 - 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	0
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	0
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,557	0.0	0	0
Hours Off	0.0	0	6,240	0	0	5,904	0.0	0	6,203	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	17,280	85	3,655	10
Feb	15,584	85	2,989	10
March	17,756	85	1,489	7
April	15,310	83	234	4
May	17,693	98	0	0
June	18,561	100	0	0
July	17,843	100	0	0
Aug	19,367	100	0	0
Sept	16,385	97	0	0
Oct	16,574	97	8	2
Nov	15,899	85	1,381	7
Dec	16,525	85	2,777	8
Total	204,777	100	12,532	10

Building Energy Consumption = 46,926 (Btu/Sq Ft/Year)   Floor Area = 41,601 (Sq Ft)
Source Energy Consumption = 47,858 (Btu/Sq Ft/Year)

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**                                                                          **
**               T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                          **
**               by              **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 128
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:52: 3 1/ 3/92
Dataset Name: 128 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Peaked at Time ==>		Mo/Hr: 0/ 0				Mo/Hr: 0/ 0			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				OADB: 0			OADB: 24	
Envelope Loads										
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-86,746	-86,746	9.19
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-266,247	-266,247	28.22
Wall Cond	0	0		0	0.00	0	0.00	-248,874	-248,874	26.37
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-28,776	-28,776	3.05
Infiltration	0			0	0.00	0	0.00	-312,956	-312,956	33.17
Sub Total==>	0	0		0	0.00	0	0.00	-943,598	-943,598	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-943,598	-943,598	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	42,830		
Part	16,612		
ExFlr	872		
Roof	14,496	0	0
Wall	26,150	4,806	18

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,284.6	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,284.6			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	7,428
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-29.99

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 128

B U I L D I N G U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.265	0.000	43.9	8.78
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.265	0.000	36.3	7.26
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.136	1.140	1.259	0.265	0.000	87.8	18.45
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.136	1.140	1.259	0.265	0.000	56.2	11.54
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.136	1.140	1.259	0.265	0.000	56.2	11.54
Building		0.388	0.750	0.000	0.000	0.136	1.140	1.259	0.265	0.000	56.2	11.54

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 128

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	13,835	13,835	10,346	872	0	0	0	1,602	18	7,115
2	2ND FLOOR	1	1	14,499	14,499	3,133	0	0	0	0	1,602	18	7,115
3	3RD FLOOR	1	1	14,496	14,496	3,133	0	0	0	14,496	1,602	18	7,115
Zone	1 Total/Ave.				42,830	16,612	872	0	0	14,496	4,806	18	21,344
System	1 Total/Ave.				42,830	16,612	872	0	0	14,496	4,806	18	21,344
Building					42,830	16,612	872	0	0	14,496	4,806	18	21,344

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 128

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-64,230	19	383	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-128,460	14	279	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-192,690	13	268	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-256,920	11	225	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-321,150	13	261	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-385,380	16	336	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-449,610	9	175	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-513,840	5	112	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-578,070	0	0	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-642,300	0	0	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-706,530	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-770,760	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-834,990	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-899,220	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-963,450	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-1,027,680	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-1,091,910	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,156,140	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,220,370	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,284,600	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,721	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	14,831	68	2,878	11
Feb	13,411	68	2,057	11
March	14,027	68	253	6
April	11,693	64	0	0
May	12,708	64	0	0
June	12,631	64	0	0
July	11,770	64	0	0
Aug	13,177	64	0	0
Sept	11,693	64	0	0
Oct	12,708	64	0	0
Nov	13,306	68	409	5
Dec	14,362	68	1,918	9
Total	156,314	68	7,514	11

Building Energy Consumption = 30,000 (Btu/Sq Ft/Year)   Floor Area = 42,830 (Sq Ft)
Source Energy Consumption = 30,543 (Btu/Sq Ft/Year)

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**              T R A C E   6 0 0   A N A L Y S I S                          **
**                                                                           **
**              by          **
**                                                                           **
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ESOS STUDY AT WSMR - BUILDING 128
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:28: 1 1/20/92
Dataset Name: 128 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK *****

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-86,746	-86,746	12.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-67,335	-67,335	9.32
Wall Cond	0	0		0	0.00	0	0.00	-248,874	-248,874	34.43
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-28,776	-28,776	3.98
Infiltration	0			0	0.00	0	0.00	-291,049	-291,049	40.27
Sub Total==>	0	0		0	0.00	0	0.00	-722,780	-722,780	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-722,780	-722,780	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	42,830		
Part	16,612		
ExFlr	872		
Roof	14,496	0	0
Wall	26,150	4,806	18

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,284.6	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,284.6			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	6,908
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-29.99

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 128

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.265	0.000	43.9	8.78
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	0.310	0.318	0.265	0.000	36.3	7.26
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.136	0.310	0.318	0.265	0.000	87.8	18.45
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.136	0.310	0.318	0.265	0.000	56.2	11.54
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.136	0.310	0.318	0.265	0.000	56.2	11.54
Building		0.388	0.750	0.000	0.000	0.136	0.310	0.318	0.265	0.000	56.2	11.54

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 128

--- B U I L D I N G   A R E A S ---

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	[illegible]ndow [illegible]rea ([illegible]qft)	Win /Wl (%)	Net W[illegible]l A[illegible]a (sq[illegible])
1	1ST FLOOR	1	1	13,835	13,835	10,346	872	0	0	0	[illegible],602	18	7,[illegible]5
2	2ND FLOOR	1	1	14,499	14,499	3,133	0	0	0	0	[illegible],602	18	7,[illegible]5
3	3RD FLOOR	1	1	14,496	14,496	3,133	0	0	0	14,496	[illegible],602	18	7,[illegible]5
Zone	1 Total/Ave.				42,830	16,612	872	0	0	14,496	[illegible],806	18	21,[illegible]4
System	1 Total/Ave.				42,830	16,612	872	0	0	14,496	[illegible],806	18	21,[illegible]4
Building					42,830	16,612	872	0	0	14,496	[illegible],806	18	21,[illegible]4

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 128

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-64,230	20	367	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-128,460	18	329	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-192,690	14	254	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-256,920	14	268	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-321,150	12	231	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-385,380	11	199	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-449,610	10	191	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-513,840	2	31	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-578,070	0	0	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-642,300	0	0	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-706,530	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-770,760	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-834,990	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-899,220	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-963,450	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-1,027,680	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-1,091,910	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,156,140	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,220,370	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,284,600	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,890	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	14,831	68	2,506	8
Feb	13,243	68	1,639	8
March	13,999	68	207	5
April	11,693	64	0	0
May	12,708	64	0	0
June	12,631	64	0	0
July	11,770	64	0	0
Aug	13,177	64	0	0
Sept	11,693	64	0	0
Oct	12,708	64	0	0
Nov	12,337	68	280	5
Dec	13,686	68	1,585	7
Total	154,474	68	6,218	8

Building Energy Consumption = 26,827 (Btu/Sq Ft/Year)   Floor Area = 42,830 (Sq Ft)
Source Energy Consumption = 27,276 (Btu/Sq Ft/Year)

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**                                                                         **
**                  T R A C E   6 0 0   A N A L Y S I S                    **
**                                                                         **
**                  by             **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 129
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO#9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:55:42 1/22/92
Dataset Name: 129 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ******

						*			*			
Peaked at Time ==>		Mo/Hr: 0/ 0				*	Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				*	OADB: 0		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-59,808	-59,808	10.91
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-139,673	-139,673	25.49
Wall Cond	0	0		0	0.00	*	0	0.00	*	-155,054	-155,054	28.29
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	-193,491	-193,491	35.31
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-548,026	-548,026	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-548,026	-548,026	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	24,714		
Part	8,482		
ExFlr	0		
Roof	12,357	0	0
Wall	15,819	2,521	16

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,057.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,057.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	4,593
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-42.77

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Block UH - UNIT HEATERS

	COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-12,466	-12,466	35.27
Wall Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	-8,589	-8,589	24.30
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	-14,289	-14,289	40.43
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-35,344	-35,344	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-35,344	-35,344	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	3,634		
Part	6,052		
ExFlr	0		
Roof	0	0	0
Wall	225	225	100

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-80.2	1,480	36.4	92.9
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-80.2			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	339
Supply	0	1,480
Mincfm	0	0
Return	0	1,480
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.41
Htg Btuh/SqFt	-22.06

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	92.9
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 129

B U I L D I N G U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.124	0.000	0.000	0.000	0.000	1.140	1.259	0.265	0.000	43.8	8.75
2	2ND FLOOR	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	97.1	20.31
Zone	1 Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
System	1 Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
3	BASEMENT	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Zone	2 Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
System	2 Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Building		0.146	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 129

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,357	12,357	4,132	0	0	0	0	1,261	16	6,446
2	2ND FLOOR	1	1	12,357	12,357	4,350	0	0	0	12,357	1,261	16	6,852
Zone	1 Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
System	1 Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
3	BASEMENT	1	1	3,634	3,634	6,052	0	0	0	0	225	100	0
Zone	2 Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
System	2 Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
Building					28,348	14,534	0	0	0	12,357	2,746	17	13,298

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-56,856	26	668	74.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-113,712	17	420	148.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-170,568	16	396	222.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-227,424	18	448	296.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-284,280	14	351	370.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-341,136	9	239	444.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-625,416	0	0	814.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-739,128	0	0	962.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-966,552	0	0	1,258.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,238	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	9,908	45	1,733	6
Feb	8,821	45	1,300	6
March	10,259	45	219	3
April	7,739	45	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
Oct	8,411	43	0	0
Nov	8,767	45	363	3
Dec	9,598	45	1,250	5
Total	104,524	45	4,865	6

Building Energy Consumption = 29,745 (Btu/Sq Ft/Year)   Floor Area = 28,348 (Sq Ft)
Source Energy Consumption = 30,275 (Btu/Sq Ft/Year)

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**                                                                            **
**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by              **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 129
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO √ (CLEAR)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 15:43:39 1/23/92
Dataset Name: 129 .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

	COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-59,808	-59,808	13.90
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-35,324	-35,324	8.21
Wall Cond	0	0		0	0.00	*	0	0.00	*	-155,054	-155,054	36.05
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	-179,947	-179,947	41.84
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-430,133	-430,133	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-430,133	-430,133	100.00

---------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	24,714		
Part	8,482		
ExFlr	0		
Roof	12,357	0	0
Wall	15,819	2,521	16

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,057.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,057.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	4,271
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-42.77

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Block UH - UNIT HEATERS

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-3,153	-3,153	12.11
Wall Cond	0	0		0	0.00	0	0.00	0	0	0.00
Partition	0			0	0.00	0	0.00	-8,589	-8,589	33.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-14,289	-14,289	54.89
Sub Total==>	0	0		0	0.00	0	0.00	-26,030	-26,030	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-26,030	-26,030	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	3,634		
Part	6,052		
ExFlr	0		
Roof	0	0	0
Wall	225	225	100

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-80.2	1,480	29.8	86.4
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-80.2			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	339
Supply	0	1,480
Mincfm	0	0
Return	0	1,480
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.41
Htg Btuh/SqFt	-22.06

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	86.4
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 129

B U I L D I N G U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.124	0.000	0.000	0.000	0.000	0.310	0.318	0.265	0.000	43.8	8.75
2	2ND FLOOR	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	97.1	20.31
Zone 1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
System 1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
3	BASEMENT	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Zone 2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
System 2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Building		0.146	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 129

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,357	12,357	4,132	0	0	0	0	1,261	16	6,446
2	2ND FLOOR	1	1	12,357	12,357	4,350	0	0	0	12,357	1,261	16	6,852
Zone 1	Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
System 1	Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
3	BASEMENT	1	1	3,634	3,634	6,052	0	0	0	0	225	100	0
Zone 2	Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
System 2	Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
Building					28,348	14,534	0	0	0	12,357	2,746	17	13,298

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-56,856	25	561	74.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-113,712	22	496	148.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-170,568	18	398	222.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-227,424	14	311	296.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-284,280	17	395	370.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-341,136	5	112	444.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-625,416	0	0	814.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-739,128	0	0	962.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-966,552	0	0	1,258.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,487	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	9,908	45	1,579	5
Feb	8,921	45	1,102	5
March	9,178	45	165	3
April	7,739	43	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
Oct	8,411	43	0	0
Nov	8,334	45	222	3
Dec	9,598	45	1,111	4
Total	103,110	45	4,179	5

Building Energy Consumption = 27,157 (Btu/Sq Ft/Year) Floor Area = 28,348 (Sq Ft)
Source Energy Consumption = 27,613 (Btu/Sq Ft/Year)

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**              T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                          **
**              by          **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 143
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO#9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 9:40:48 1/23/92
Dataset Name: 143 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK **

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-59,808	-59,808	10.91
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-139,673	-139,673	25.49
Wall Cond	0	0		0	0.00	0	0.00	-155,054	-155,054	28.29
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-193,491	-193,491	35.31
Sub Total==>	0	0		0	0.00	0	0.00	-548,026	-548,026	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-548,026	-548,026	100.00

---------------------------------COOLING COIL SELECTION---------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	24,714		
Part	8,482		
ExFlr	0		
Roof	12,357	0	0
Wall	15,819	2,521	16

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,057.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,057.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	4,593
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-42.77

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Block UH - UNIT HEATERS

************************ COOLING COIL PEAK ****************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak					*	Clg Space Peak		*	Heating Coil Peak		
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads												
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-12,466	-12,466	35.27
Wall Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	-8,589	-8,589	24.30
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	-14,289	-14,289	40.43
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-35,344	-35,344	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-35,344	-35,344	100.00

--------------------------------COOLING COIL SELECTION--------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
					DB	WB	HR	DB	WB	HR
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	3,634		
Part	6,052		
ExFlr	0		
Roof	0	0	0
Wall	225	225	100

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-80.2	1,480	36.4	92.9
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-80.2			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	339
Supply	0	1,480
Mincfm	0	0
Return	0	1,480
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.41
Htg Btuh/SqFt	-22.06

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	92.9
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 143

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.124	0.000	0.000	0.000	0.000	1.140	1.259	0.265	0.000	43.8	8.75
2	2ND FLOOR	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	97.1	20.31
Zone	1 Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
System	1 Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
3	BASEMENT	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Zone	2 Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
System	2 Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Building		0.146	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 143

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,357	12,357	4,132	0	0	0	0	1,261	16	6,446
2	2ND FLOOR	1	1	12,357	12,357	4,350	0	0	0	12,357	1,261	16	6,852
Zone	1 Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
System	1 Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
3	BASEMENT	1	1	3,634	3,634	6,052	0	0	0	0	225	100	0
Zone	2 Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
System	2 Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
Building					28,348	14,534	0	0	0	12,357	2,746	17	13,298

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow ----			---- Heating Airflow ----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-56,856	26	668	74.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-113,712	17	420	148.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-170,568	16	396	222.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-227,424	18	448	296.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-284,280	14	351	370.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-341,136	9	239	444.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-625,416	0	0	814.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-739,128	0	0	962.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-966,552	0	0	1,258.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,238	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	9,908	45	1,733	6
Feb	8,821	45	1,300	6
March	10,259	45	219	3
April	7,739	45	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
Oct	8,411	43	0	0
Nov	8,767	45	363	3
Dec	9,598	45	1,250	5
Total	104,524	45	4,865	6

Building Energy Consumption = 29,745 (Btu/Sq Ft/Year) Floor Area = 28,348 (Sq Ft)
Source Energy Consumption = 30,275 (Btu/Sq Ft/Year)

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**                                                                            **
**            T R A C E   6 0 0   A N A L Y S I S                             **
**                                                                            **
**            by          **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 143
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECO#9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:13:32 1/23/92
Dataset Name: 143 .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK **

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-59,808	-59,808	13.90
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-35,324	-35,324	8.21
Wall Cond	0	0		0	0.00	0	0.00	-155,054	-155,054	36.05
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-179,947	-179,947	41.84
Sub Total==>	0	0		0	0.00	0	0.00	-430,133	-430,133	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-430,133	-430,133	100.00

----------COOLING COIL SELECTION----------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

----------AREAS----------

	Gross Total	Glass (sf)	(%)
Floor	24,714		
Part	8,482		
ExFlr	0		
Roof	12,357	0	0
Wall	15,819	2,521	16

----------HEATING COIL SELECTION----------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,057.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,057.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	4,271
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-42.77

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Block UH - UNIT HEATERS

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak					Clg Space Peak		Heating Coil Peak		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-3,153	-3,153	12.11
Wall Cond	0	0		0	0.00	0	0.00	0	0	0.00
Partition	0			0	0.00	0	0.00	-8,589	-8,589	33.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-14,289	-14,289	54.89
Sub Total==>	0	0		0	0.00	0	0.00	-26,030	-26,030	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-26,030	-26,030	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	3,634		
Part	6,052		
ExFlr	0		
Roof	0	0	0
Wall	225	225	100

-----------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-80.2	1,480	29.8	86.4
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-80.2			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	339
Supply	0	1,480
Mincfm	0	0
Return	0	1,480
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.41
Htg Btuh/SqFt	-22.06

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	86.4
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 143

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.124	0.000	0.000	0.000	0.000	0.310	0.318	0.265	0.000	43.8	8.75
2	2ND FLOOR	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	97.1	20.31
Zone	1 Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
System	1 Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
3	BASEMENT	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Zone	2 Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
System	2 Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Building		0.146	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 143

---------------------------------- B U I L D I N G   A R E A S ----------------------------------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Area (sqft)
1	1ST FLOOR	1	1	12,357	12,357	4,132	0	0	0	0	1,261	16	6,446
2	2ND FLOOR	1	1	12,357	12,357	4,350	0	0	0	12,357	1,261	16	6,852
Zone	1 Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
System	1 Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
3	BASEMENT	1	1	3,634	3,634	6,052	0	0	0	0	225	100	0
Zone	2 Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
System	2 Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
Building					28,348	14,534	0	0	0	12,357	2,746	17	13,298

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

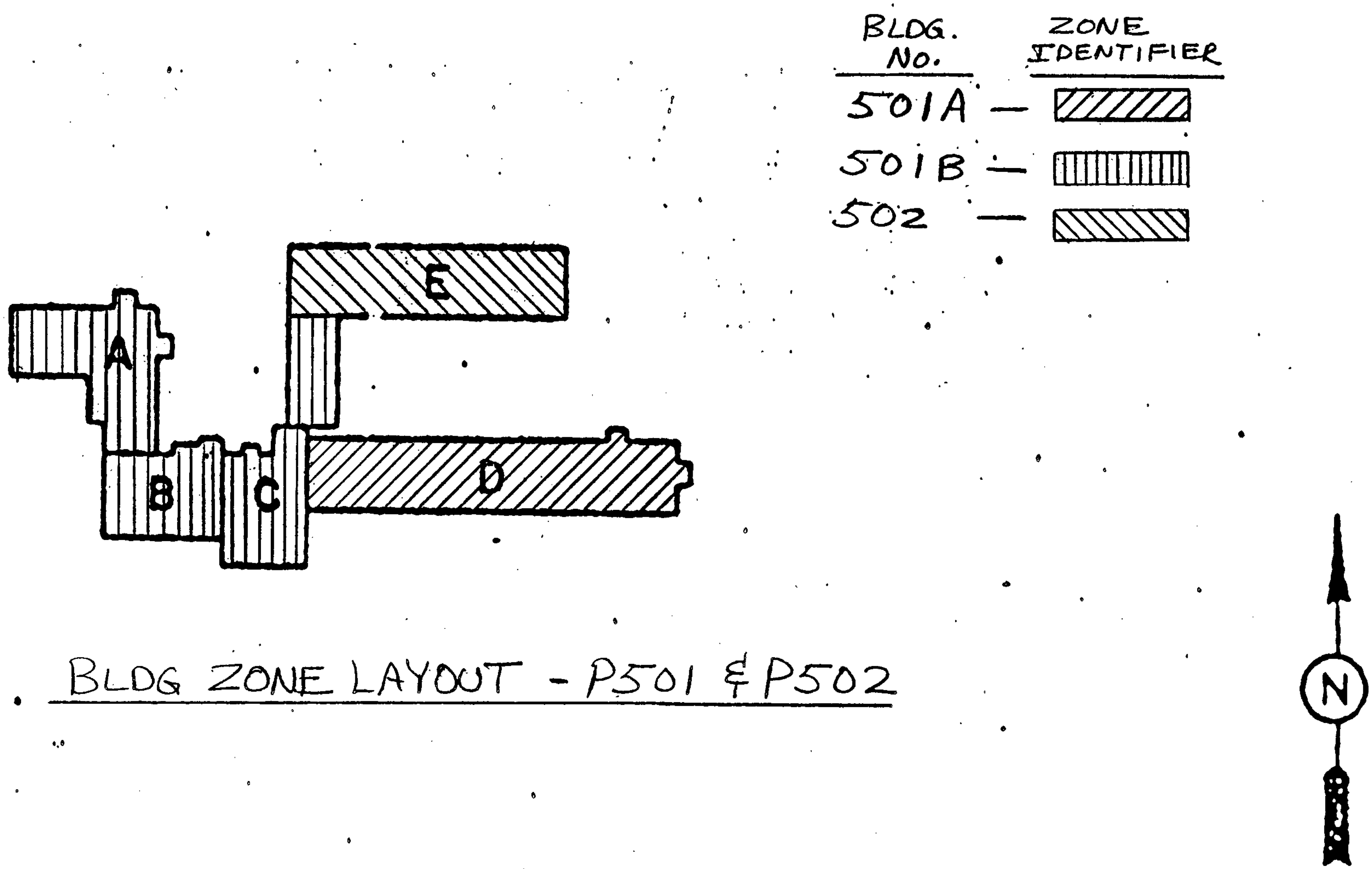
Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-56,856	25	561	74.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-113,712	22	496	148.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-170,568	18	398	222.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-227,424	14	311	296.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-284,280	17	395	370.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-341,136	5	112	444.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-625,416	0	0	814.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-739,128	0	0	962.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-966,552	0	0	1,258.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,487	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	9,908	45	1,579	5
Feb	8,921	45	1,102	5
March	9,178	45	165	3
April	7,739	43	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
Oct	8,411	43	0	0
Nov	8,334	45	222	3
Dec	9,598	45	1,111	4
Total	103,110	45	4,179	5

Building Energy Consumption = 27,157 (Btu/Sq Ft/Year)   Floor Area = 28,348 (Sq Ft)
Source Energy Consumption = 27,613 (Btu/Sq Ft/Year)



BLDG ZONE LAYOUT - P501 & P502

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**              T R A C E   6 0 0   A N A L Y S I S                       **
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ESOS STUDY AT WSMR - BUILDING 501-A
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: April To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 20: 5: 0 1/15/92
Dataset Name: 501-A .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************ COOLING COIL PEAK ******************************* CLG SPACE PEAK ************ HEATING COIL PEAK ***

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 7/19		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					OADB: 91		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	14,014	0		14,014	4.80	19,030	7.39	-16,227	-16,227	4.01
Glass Solar	66,787	0		66,787	22.86	36,983	14.37	0	0	0.00
Glass Cond	40,576	0		40,576	13.89	32,841	12.76	-107,844	-107,844	26.64
Wall Cond	66,506	0		66,506	22.76	88,122	34.23	-132,100	-132,100	32.63
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-15,048	-15,048	3.72
Infiltration	0			0	0.00	0	0.00	-133,600	-133,600	33.00
Sub Total==>	187,883	0		187,883	64.31	176,977	68.74	-404,818	-404,818	100.00
Internal Loads										
Lights	42,911	0		42,911	14.69	69,515	27.00	0	0	0.00
People	14,112			14,112	4.83	10,948	4.25	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	57,023	0	0	57,023	19.52	80,463	31.26	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	47,242	16.17	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	244,906	0	0	292,148	100.00	257,440	100.00	-404,818	-404,818	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	44.3	531.4	535.6	14,937	81.9	59.5	52.4	60.0	45.2	28.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	44.3	531.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	16,764		
Part	18,808		
ExFlr	456		
Roof	8,382	0	0
Wall	10,333	1,947	19

------------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-557.3	14,937	57.3	96.3
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	14,937	58.7	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-557.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	3,171	0
Infil	0	3,171
Supply	14,937	14,937
Mincfm	0	0
Return	14,937	14,937
Exhaust	3,171	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	21.2
Clg Cfm/Sqft	0.89
Clg Cfm/Ton	337.33
Clg Sqft/Ton	378.58
Clg Btuh/Sqft	31.70
No. People	56
Htg % OA	0.0
Htg Cfm/SqFt	0.89
Htg Btuh/SqFt	-33.24

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	96.3
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	81.9	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 501-A

B U I L D I N G U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	49.0	9.80
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	1.140	1.259	0.358	0.000	98.5	20.59
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	73.7	15.19
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	73.7	15.19
Building		0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	73.7	15.19

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 501-A

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND FLOOR	1	1	8,382	8,382	9,213	0	0	0	8,382	1,014	20	4,047
Zone	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
System	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
Building					16,764	18,808	456	0	0	8,382	1,947	19	8,386

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	2.2	12	337	-27,864	9	148	746.8	0	0	0.0	0	0
5 - 10	4.4	8	223	-55,728	14	249	1,493.7	0	0	0.0	0	0
10 - 15	6.6	11	298	-83,592	7	113	2,240.5	0	0	0.0	0	0
15 - 20	8.9	8	224	-111,456	8	136	2,987.4	0	0	0.0	0	0
20 - 25	11.1	10	273	-139,320	10	173	3,734.2	0	0	0.0	0	0
25 - 30	13.3	11	299	-167,184	13	231	4,481.1	0	0	0.0	0	0
30 - 35	15.5	12	346	-195,048	14	239	5,227.9	0	0	0.0	0	0
35 - 40	17.7	8	236	-222,912	13	224	5,974.8	0	0	0.0	0	0
40 - 45	19.9	6	177	-250,776	7	117	6,721.6	0	0	0.0	0	0
45 - 50	22.1	12	324	-278,640	5	79	7,468.5	0	0	0.0	0	0
50 - 55	24.4	1	40	-306,504	1	10	8,215.3	0	0	0.0	0	0
55 - 60	26.6	0	0	-334,368	0	0	8,962.2	0	0	0.0	0	0
60 - 65	28.8	0	0	-362,232	0	0	9,709.0	0	0	0.0	0	0
65 - 70	31.0	0	0	-390,096	0	0	10,455.9	0	0	0.0	0	0
70 - 75	33.2	0	0	-417,960	0	0	11,202.7	0	0	0.0	0	0
75 - 80	35.4	0	0	-445,824	0	0	11,949.6	0	0	0.0	0	0
80 - 85	37.6	0	0	-473,688	0	0	12,696.4	0	0	0.0	0	0
85 - 90	39.9	0	0	-501,552	0	0	13,443.3	0	0	0.0	0	0
90 - 95	42.1	0	0	-529,416	0	0	14,190.1	0	0	0.0	0	0
95 - 100	44.3	0	0	-557,280	0	0	14,937.0	100	8,760	0.0	0	0
Hours Off	0.0	0	5,983	0	0	7,041	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	30,267	108
Feb	23,697	106
March	7,583	60
April	5,834	26
May	11,315	52
June	17,085	61
July	18,845	62
Aug	18,359	61
Sept	11,840	53
Oct	6,960	44
Nov	7,608	57
Dec	19,298	86
Total	178,690	108

Building Energy Consumption = 36,381 (Btu/Sq Ft/Year)   Floor Area = 16,764 (Sq Ft)
Source Energy Consumption = 36,381 (Btu/Sq Ft/Year)

Σ monthly peak demand = 776

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**              T R A C E    6 0 0    A N A L Y S I S                      **
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ESOS STUDY AT WSMR - BUILDING 501-A
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: April To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:13: 9 1/18/92
Dataset Name: 501-A .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ***

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 7/19		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					OADB: 91		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	12,613	0		12,613	4.78	19,030	8.05	-16,227	-16,227	5.15
Glass Solar	76,846	0		76,846	29.09	38,930	16.47	0	0	0.00
Glass Cond	10,531	0		10,531	3.99	8,439	3.57	-27,274	-27,274	8.66
Wall Cond	66,216	0		66,216	25.07	89,520	37.87	-132,100	-132,100	41.95
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-15,048	-15,048	4.78
Infiltration	0			0	0.00	0	0.00	-124,248	-124,248	39.46
Sub Total==>	166,206	0		166,206	62.93	155,919	65.96	-314,897	-314,897	100.00
Internal Loads										
Lights	42,911	0		42,911	16.25	69,515	29.41	0	0	0.00
People	14,112			14,112	5.34	10,948	4.63	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	57,023	0	0	57,023	21.59	80,463	34.04	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	40,901	15.49	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	223,228	0	0	264,129	100.00	236,382	100.00	-314,897	-314,897	100.00

-------------------------------COOLING COIL SELECTION-------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	44.3	531.4	536.2	13,715	81.8	59.5	52.7	60.0	43.7	23.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	44.3	531.4								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	16,764		
Part	18,808		
ExFlr	456		
Roof	8,382	0	0
Wall	10,333	1,947	19

-----------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-557.3	13,715	49.5	92.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	13,715	58.5	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-557.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,949	0
Infil	0	2,949
Supply	13,715	13,715
Mincfm	0	0
Return	13,715	13,715
Exhaust	2,949	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	21.5
Clg Cfm/Sqft	0.82
Clg Cfm/Ton	309.74
Clg Sqft/Ton	378.58
Clg Btuh/Sqft	31.70
No. People	56
Htg % OA	0.0
Htg Cfm/SqFt	0.82
Htg Btuh/SqFt	-33.24

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	92.0
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	81.8	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG 501-A

B U I L D I N G   U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	49.0	9.80
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.310	0.318	0.358	0.000	98.5	20.59
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
Building		0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG 501-A

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND FLOOR	1	1	8,382	8,382	9,213	0	.0	0	8,382	1,014	20	4,047
Zone	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
System	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
Building					16,764	18,808	456	0	0	8,382	1,947	19	8,386

‡

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	2.2	11	313	-27,864	11	166	685.8	0	0	0.0	0	0
5 - 10	4.4	8	237	-55,728	13	197	1,371.5	0	0	0.0	0	0
10 - 15	6.6	12	359	-83,592	9	134	2,057.3	0	0	0.0	0	0
15 - 20	8.9	10	285	-111,456	8	132	2,743.0	0	0	0.0	0	0
20 - 25	11.1	10	288	-139,320	13	201	3,428.8	0	0	0.0	0	0
25 - 30	13.3	14	394	-167,184	11	170	4,114.5	0	0	0.0	0	0
30 - 35	15.5	11	317	-195,048	15	229	4,800.3	0	0	0.0	0	0
35 - 40	17.7	10	296	-222,912	12	181	5,486.1	0	0	0.0	0	0
40 - 45	19.9	11	327	-250,776	7	109	6,171.8	0	0	0.0	0	0
45 - 50	22.1	3	83	-278,640	3	39	6,857.6	0	0	0.0	0	0
50 - 55	24.4	0	0	-306,504	0	0	7,543.3	0	0	0.0	0	0
55 - 60	26.6	0	0	-334,368	0	0	8,229.1	0	0	0.0	0	0
60 - 65	28.8	0	0	-362,232	0	0	8,914.9	0	0	0.0	0	0
65 - 70	31.0	0	0	-390,096	0	0	9,600.6	0	0	0.0	0	0
70 - 75	33.2	0	0	-417,960	0	0	10,286.4	0	0	0.0	0	0
75 - 80	35.4	0	0	-445,824	0	0	10,972.1	0	0	0.0	0	0
80 - 85	37.6	0	0	-473,688	0	0	11,657.9	0	0	0.0	0	0
85 - 90	39.9	0	0	-501,552	0	0	12,343.6	0	0	0.0	0	0
90 - 95	42.1	0	0	-529,416	0	0	13,029.4	0	0	0.0	0	0
95 - 100	44.3	0	0	-557,280	0	0	13,715.2	100	8,760	0.0	0	0
Hours Off	0.0	0	5,861	0	0	7,202	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	27,298	86
Feb	20,766	85
March	7,360	56
April	5,834	31
May	11,503	51
June	16,527	58
July	18,095	59
Aug	18,076	58
Sept	12,100	52
Oct	7,204	45
Nov	7,323	55
Dec	16,961	68
Total	169,048	86

Building Energy Consumption = 34,417 (Btu/Sq Ft/Year)   Floor Area = 16,764 (Sq Ft)
Source Energy Consumption = 34,417 (Btu/Sq Ft/Year)

Σ monthly kw = 704

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**               T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                           **
**               by             **
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ESOS STUDY AT WSMR - BUILDING 501-A
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT ~~2~~ 3-ECO (GREY) (ECO#9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: April To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:32:57 1/18/92
Dataset Name: 501-A .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ***

						*			*			
Peaked at Time ==>		Mo/Hr: 7/16				*	Mo/Hr: 7/19		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				*	OADB: 91		*		OADB: 24	
	Space	Ret. Air	Ret. Air	Net	Percnt	*	Space	Percnt	*	Space Peak	Coil Peak	Percnt
	Sens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensible	Of Tot	*	Space Sens	Tot Sens	Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	16,301	0		16,301	6.88	*	19,030	8.58	*	-16,227	-16,227	5.15
Glass Solar	36,902	0		36,902	15.57	*	25,304	11.41	*	0	0	0.00
Glass Cond	11,368	0		11,368	4.80	*	8,931	4.03	*	-27,274	-27,274	8.66
Wall Cond	72,043	0		72,043	30.39	*	88,122	39.72	*	-132,100	-132,100	41.95
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-15,048	-15,048	4.78
Infiltration	0			0	0.00	*	0	0.00	*	-124,248	-124,248	39.46
Sub Total==>	136,614	0		136,614	57.64	*	141,387	63.73	*	-314,897	-314,897	100.00
Internal Loads						*			*			
Lights	42,911	0		42,911	18.10	*	69,515	31.33	*	0	0	0.00
People	14,112			14,112	5.95	*	10,948	4.93	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	57,023	0	0	57,023	24.06	*	80,463	36.27	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	43,393	18.31	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	[illegible]
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	193,637	0	0	237,029	100.00	*	221,850	100.00	*	-314,897	-314,897	100.00

-----------------------------------COOLING COIL SELECTION----------------------------------- --------------AREAS--------------

	Total Capacity		Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR		
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains
Main Clg	44.3	531.4	537.3	12,872	82.3	59.6	52.7	60.0	42.7	19.8
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	44.3	531.4								

	Gross Total	Glass (sf)	(%)
Floor	16,764		
Part	18,808		
ExFlr	456		
Roof	8,382	0	0
Wall	10,333	1,947	19

------------HEATING COIL SELECTION------------

	Capacity	Coil Airfl	Ent	Lvg
	(Mbh)	(cfm)	Deg F	Deg F
Main Htg	-557.3	12,872	48.3	93.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	12,872	57.9	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-557.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,949	0
Infil	0	2,949
Supply	12,872	12,872
Mincfm	0	0
Return	12,872	12,872
Exhaust	2,949	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	22.9
Clg Cfm/Sqft	0.77
Clg Cfm/Ton	290.70
Clg Sqft/Ton	378.58
Clg Btuh/Sqft	31.70
No. People	56
Htg % OA	0.0
Htg Cfm/SqFt	0.77
Htg Btuh/SqFt	-33.24

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	93.5
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	82.3	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG 501-A

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	49.0	9.80
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.310	0.318	0.358	0.000	98.5	20.59
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
Building		0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19

BUILDING AREAS - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG 501-A

---------------------------------- B U I L D I N G   A R E A S ----------------------------------

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND FLOOR	1	1	8,382	8,382	9,213	0	0	0	8,382	1,014	20	4,047
Zone	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
System	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
Building					16,764	18,808	456	0	0	8,382	1,947	19	8,386

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	2.2	11	313	-27,864	13	218	643.6	0	0	0.0	0	0
5 - 10	4.4	10	300	-55,728	11	182	1,287.2	0	0	0.0	0	0
10 - 15	6.6	13	361	-83,592	9	150	1,930.8	0	0	0.0	0	0
15 - 20	8.9	10	285	-111,456	7	127	2,574.4	0	0	0.0	0	0
20 - 25	11.1	11	311	-139,320	13	221	3,218.0	0	0	0.0	0	0
25 - 30	13.3	13	370	-167,184	11	179	3,861.6	0	0	0.0	0	0
30 - 35	15.5	13	369	-195,048	17	280	4,505.2	0	0	0.0	0	0
35 - 40	17.7	7	214	-222,912	11	181	5,148.8	0	0	0.0	0	0
40 - 45	19.9	11	305	-250,776	7	118	5,792.4	0	0	0.0	0	0
45 - 50	22.1	1	40	-278,640	2	39	6,436.0	0	0	0.0	0	0
50 - 55	24.4	0	0	-306,504	0	0	7,079.6	0	0	0.0	0	0
55 - 60	26.6	0	0	-334,368	0	0	7,723.2	0	0	0.0	0	0
60 - 65	28.8	0	0	-362,232	0	0	8,366.8	0	0	0.0	0	0
65 - 70	31.0	0	0	-390,096	0	0	9,010.4	0	0	0.0	0	0
70 - 75	33.2	0	0	-417,960	0	0	9,654.0	0	0	0.0	0	0
75 - 80	35.4	0	0	-445,824	0	0	10,297.6	0	0	0.0	0	0
80 - 85	37.6	0	0	-473,688	0	0	10,941.2	0	0	0.0	0	0
85 - 90	39.9	0	0	-501,552	0	0	11,584.8	0	0	0.0	0	0
90 - 95	42.1	0	0	-529,416	0	0	12,228.4	0	0	0.0	0	0
95 - 100	44.3	0	0	-557,280	0	0	12,872.0	100	8,760	0.0	0	0
Hours Off	0.0	0	5,892	0	0	7,065	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	28,547	86
Feb	21,818	85
March	7,450	56
April	5,834	26
May	11,249	49
June	15,939	56
July	17,487	57
Aug	17,419	56
Sept	11,423	50
Oct	7,059	43
Nov	7,439	55
Dec	17,948	68
Total	169,612	86

Building Energy Consumption = 34,532 (Btu/Sq Ft/Year)   Floor Area = 16,764 (Sq Ft)
Source Energy Consumption = 34,532 (Btu/Sq Ft/Year)

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**                                                                         **
**              T R A C E   6 0 0   A N A L Y S I S                        **
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**              by             **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 501-A
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT ~~2~~ 4-ECO (Bronze) (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: April To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:50:31 1/18/92
Dataset Name: 501-A .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK **

Peaked at Time ==>		Mo/Hr: 7/16				Mo/Hr: 7/19		Mo/Hr: 13/ 1		
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				OADB: 91		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	16,301	0		16,301	6.88	19,030	8.58	-16,227	-16,227	5.15
Glass Solar	36,902	0		36,902	15.57	25,304	11.41	0	0	0.00
Glass Cond	11,368	0		11,368	4.80	8,931	4.03	-27,274	-27,274	8.66
Wall Cond	72,043	0		72,043	30.39	88,122	39.72	-132,100	-132,100	41.95
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-15,048	-15,048	4.78
Infiltration	0			0	0.00	0	0.00	-124,248	-124,248	39.46
Sub Total==>	136,614	0		136,614	57.64	141,387	63.73	-314,897	-314,897	100.00
Internal Loads										
Lights	42,911	0		42,911	18.10	69,515	31.33	0	0	0.00
People	14,112			14,112	5.95	10,948	4.93	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	57,023	0	0	57,023	24.06	80,463	36.27	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	43,393	18.31	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	193,637	0	0	237,029	100.00	221,850	100.00	-314,897	-314,897	100.00

--------------------------------COOLING COIL SELECTION--------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	44.3	531.4	537.3	12,872	82.3	59.6	52.7	60.0	42.7	19.8
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	44.3	531.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	16,764		
Part	18,808		
ExFlr	456		
Roof	8,382	0	0
Wall	10,333	1,947	19

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-557.3	12,872	48.3	93.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	12,872	57.9	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-557.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,949	0
Infil	0	2,949
Supply	12,872	12,872
Mincfm	0	0
Return	12,872	12,872
Exhaust	2,949	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	22.9
Clg Cfm/Sqft	0.77
Clg Cfm/Ton	290.70
Clg Sqft/Ton	378.58
Clg Btuh/Sqft	31.70
No. People	56
Htg % OA	0.0
Htg Cfm/SqFt	0.77
Htg Btuh/SqFt	-33.24

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	93.5
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	82.3	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG 501-A

---------------------------------- B U I L D I N G U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	49.0	9.80
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.310	0.318	0.358	0.000	98.5	20.59
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
Building		0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19

BUILDING AREAS - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG 501-A

---------------------------------- B U I L D I N G A R E A S ----------------------------------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND FLOOR	1	1	8,382	8,382	9,213	0	0	0	8,382	1,014	20	4,047
Zone	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
System	1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8,386
Building					16,764	18,808	456	0	0	8,382	1,947	19	8,386

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 4

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	2.2	11	313	-27,864	13	218	643.6	0	0	0.0	0	0
5 - 10	4.4	10	300	-55,728	11	182	1,287.2	0	0	0.0	0	0
10 - 15	6.6	13	361	-83,592	9	150	1,930.8	0	0	0.0	0	0
15 - 20	8.9	10	285	-111,456	7	127	2,574.4	0	0	0.0	0	0
20 - 25	11.1	11	311	-139,320	13	221	3,218.0	0	0	0.0	0	0
25 - 30	13.3	13	370	-167,184	11	179	3,861.6	0	0	0.0	0	0
30 - 35	15.5	13	369	-195,048	17	280	4,505.2	0	0	0.0	0	0
35 - 40	17.7	7	214	-222,912	11	181	5,148.8	0	0	0.0	0	0
40 - 45	19.9	11	305	-250,776	7	118	5,792.4	0	0	0.0	0	0
45 - 50	22.1	1	40	-278,640	2	39	6,436.0	0	0	0.0	0	0
50 - 55	24.4	0	0	-306,504	0	0	7,079.6	0	0	0.0	0	0
55 - 60	26.6	0	0	-334,368	0	0	7,723.2	0	0	0.0	0	0
60 - 65	28.8	0	0	-362,232	0	0	8,366.8	0	0	0.0	0	0
65 - 70	31.0	0	0	-390,096	0	0	9,010.4	0	0	0.0	0	0
70 - 75	33.2	0	0	-417,960	0	0	9,654.0	0	0	0.0	0	0
75 - 80	35.4	0	0	-445,824	0	0	10,297.6	0	0	0.0	0	0
80 - 85	37.6	0	0	-473,688	0	0	10,941.2	0	0	0.0	0	0
85 - 90	39.9	0	0	-501,552	0	0	11,584.8	0	0	0.0	0	0
90 - 95	42.1	0	0	-529,416	0	0	12,228.4	0	0	0.0	0	0
95 - 100	44.3	0	0	-557,280	0	0	12,872.0	100	8,760	0.0	0	0
Hours Off	0.0	0	5,892	0	0	7,065	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 4

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	28,547	86
Feb	21,818	85
March	7,450	56
April	5,834	26
May	11,249	49
June	15,939	56
July	17,487	57
Aug	17,419	56
Sept	11,423	50
Oct	7,059	43
Nov	7,439	55
Dec	17,948	68
Total	169,612	86

Building Energy Consumption = 34,532 (Btu/Sq Ft/Year)   Floor Area = 16,764 (Sq Ft)
Source Energy Consumption = 34,532 (Btu/Sq Ft/Year)

Σ monthly peak demand = 687 kW

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**              T R A C E   6 0 0   A N A L Y S I S                          **
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**              by              **
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ESOS STUDY AT WSMR - BUILDING 501-B
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC. ✓
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:25:44 1/20/92
Dataset Name: 501-B .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ***

Peaked at Time ==> Mo/Hr: 0/ 0 * Mo/Hr: 0/ 0 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 * OADB: 0 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-23,503	-23,503	5.01
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-153,914	-153,914	32.79
Wall Cond	0	0		0	0.00	0	0.00	-147,589	-147,589	31.44
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-6,347	-6,347	1.35
Infiltration	0			0	0.00	0	0.00	-138,051	-138,051	29.41
Sub Total==>	0	0		0	0.00	0	0.00	-469,404	-469,404	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-469,404	-469,404	100.00

------------------------------COOLING COIL SELECTION------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	17,165		
Part	8,622		
ExFlr	192		
Roof	12,140	0	0
Wall	12,148	2,778	23

-----------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-666.8	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-666.8			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	3,277
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-38.84

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/16					*	Mo/Hr: 9/17		*	Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					*	OADB: 86		*	OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	409	0		409	1.82	*	346	1.62	*	0	0	0.00
Glass Solar	11,151	0		11,151	49.55	*	16,254	76.13	*	0	0	0.00
Glass Cond	3,749	0		3,749	16.66	*	1,831	8.58	*	0	0	0.00
Wall Cond	1,377	0		1,377	6.12	*	1,592	7.46	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	16,686	0		16,686	74.15	*	20,024	93.78	*	0	0	0.00
Internal Loads						*			*			
Lights	1,393	0		1,393	6.19	*	738	3.46	*	0	0	0.00
People	1,680			1,680	7.47	*	589	2.76	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	3,073	0	0	3,073	13.65	*	1,327	6.22	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	2,461	10.93	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				284	1.26	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	19,759	0	0	22,504	100.00	*	21,351	100.00	*	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	2.0	24.0	22.9	800	81.0	57.8	46.0	49.9	45.4	45.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.0	24.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	272		
Part	355		
ExFlr	0		
Roof	272	0	0
Wall	366	189	52

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	800	3.9	49.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	130	0
Infil	0	0
Supply	800	0
Mincfm	0	0
Return	800	0
Exhaust	130	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	16.3
Clg Cfm/Sqft	2.94
Clg Cfm/Ton	400.00
Clg Sqft/Ton	136.03
Clg Btuh/Sqft	88.22
No. People	4
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	50.1	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	80.9	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.1	6	177	-33,339	15	255	40.0	0	0	0.0	0	0
5 - 10	0.2	9	259	-66,678	9	157	80.0	0	0	0.0	0	0
10 - 15	0.3	4	115	-100,017	10	170	120.0	0	0	0.0	0	0
15 - 20	0.4	7	203	-133,356	13	220	160.0	0	0	0.0	0	0
20 - 25	0.5	6	164	-166,695	16	265	200.0	0	0	0.0	0	0
25 - 30	0.6	6	178	-200,034	17	287	240.0	0	0	0.0	0	0
30 - 35	0.7	6	164	-233,373	13	214	280.0	0	0	0.0	0	0
35 - 40	0.8	5	145	-266,712	7	112	320.0	0	0	0.0	0	0
40 - 45	0.9	7	205	-300,051	0	0	360.0	0	0	0.0	0	0
45 - 50	1.0	5	134	-333,390	0	0	400.0	0	0	0.0	0	0
50 - 55	1.1	6	176	-366,729	0	0	440.0	0	0	0.0	0	0
55 - 60	1.2	7	194	-400,068	0	0	480.0	0	0	0.0	0	0
60 - 65	1.3	4	121	-433,407	0	0	520.0	0	0	0.0	0	0
65 - 70	1.4	5	142	-466,746	0	0	560.0	0	0	0.0	0	0
70 - 75	1.5	8	223	-500,085	0	0	600.0	0	0	0.0	0	0
75 - 80	1.6	5	153	-533,424	0	0	640.0	0	0	0.0	0	0
80 - 85	1.7	2	69	-566,763	0	0	680.0	0	0	0.0	0	0
85 - 90	1.8	1	23	-600,102	0	0	720.0	0	0	0.0	0	0
90 - 95	1.9	0	0	-633,441	0	0	760.0	0	0	0.0	0	0
95 - 100	2.0	0	0	-666,780	0	0	800.0	100	3,049	0.0	0	0
Hours Off	0.0	0	5,915	0	0	7,080	0.0	0	5,711	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	6,855	29	1,306	5
Feb	5,631	29	913	5
March	6,027	32	123	3
April	4,953	30	0	0
May	5,649	30	0	0
June	5,894	30	0	0
July	5,725	30	0	0
Aug	6,253	30	0	0
Sept	5,369	30	0	0
Oct	5,473	30	0	0
Nov	6,204	32	173	2
Dec	6,538	32	815	4
Total	70,571	32	3,329	5

Building Energy Consumption = 32,905 (Btu/Sq Ft/Year)   Floor Area = 17,438 (Sq Ft)
Source Energy Consumption = 33,495 (Btu/Sq Ft/Year)

Σ monthly kw = 364

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**               T R A C E   6 0 0   A N A L Y S I S                       **
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ESOS STUDY AT WSMR - BUILDING 501-B
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO#a) (CLEAR)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:57:58 1/20/92
Dataset Name: 501-B .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ****

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-23,503	-23,503	6.82
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-38,926	-38,926	11.29
Wall Cond	0	0		0	0.00	0	0.00	-147,589	-147,589	42.81
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-6,347	-6,347	1.84
Infiltration	0			0	0.00	0	0.00	-128,388	-128,388	37.24
Sub Total==>	0	0		0	0.00	0	0.00	-344,752	-344,752	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-344,752	-344,752	100.00

-----------------------------------COOLING COIL SELECTION----------------------------------- --------------AREAS--------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS	Gross Total	Glass (sf)	(%)
Floor	17,165		
Part	8,622		
ExFlr	192		
Roof	12,140	0	0
Wall	12,148	2,778	23

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-666.8	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-666.8			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	3,047
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-38.84

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK					**********	*	CLG SPACE PEAK	*****	*	HEATING COIL PEAK		********
Peaked at Time ==>		Mo/Hr: 9/17				*	Mo/Hr: 10/17		*		Mo/Hr: 0/ 0	
Outside Air ==>		OADB/WB/HR: 86/ 59/ 42.0				*	OADB: 78		*		OADB: 0	
						*			*			
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	346	0		346	1.60	*	156	0.73	*	0	0	0.00
Glass Solar	17,010	0		17,010	78.65	*	19,278	89.88	*	0	0	0.00
Glass Cond	498	0		498	2.30	*	35	0.16	*	0	0	0.00
Wall Cond	1,592	0		1,592	7.36	*	1,193	5.56	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	-0.00	*	0	0	0.00
Sub Total==>	19,446	0		19,446	89.91	*	20,661	96.33	*	0	0	0.00
Internal Loads						*			*			
Lights	738	0		738	3.41	*	738	3.44	*	0	0	0.00
People	779			779	3.60	*	589	2.75	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	1,517	0	0	1,517	7.01	*	1,327	6.19	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	920	4.25	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				284	1.32	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	-540			-540	-2.50	*	-540	-2.52	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	20,423	0	0	21,627	100.00	*	21,448	100.00	*	0	0	0.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	2.0	24.0	23.8	800	79.3	56.2	41.6	49.8	43.4	38.4
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.0	24.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	272		
Part	355		
ExFlr	0		
Roof	272	0	0
Wall	366	189	52

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	800	3.6	49.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	120	0
Infil	0	0
Supply	800	0
Mincfm	0	0
Return	800	0
Exhaust	120	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	15.0
Clg Cfm/Sqft	2.94
Clg Cfm/Ton	400.00
Clg Sqft/Ton	136.03
Clg Btuh/Sqft	88.22
No. People	4
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	50.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.2	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M L O A D P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.1	6	181	-33,339	17	257	40.0	0	0	0.0	0	0
5 - 10	0.2	11	326	-66,678	13	200	80.0	0	0	0.0	0	0
10 - 15	0.3	8	237	-100,017	11	169	120.0	0	0	0.0	0	0
15 - 20	0.4	8	254	-133,356	15	224	160.0	0	0	0.0	0	0
20 - 25	0.5	5	141	-166,695	13	193	200.0	0	0	0.0	0	0
25 - 30	0.6	6	176	-200,034	14	209	240.0	0	0	0.0	0	0
30 - 35	0.7	5	159	-233,373	13	190	280.0	0	0	0.0	0	0
35 - 40	0.8	6	196	-266,712	4	54	320.0	0	0	0.0	0	0
40 - 45	0.9	6	182	-300,051	0	0	360.0	0	0	0.0	0	0
45 - 50	1.0	6	197	-333,390	0	0	400.0	0	0	0.0	0	0
50 - 55	1.1	9	270	-366,729	0	0	440.0	0	0	0.0	0	0
55 - 60	1.2	4	121	-400,068	0	0	480.0	0	0	0.0	0	0
60 - 65	1.3	9	276	-433,407	0	0	520.0	0	0	0.0	0	0
65 - 70	1.4	3	106	-466,746	0	0	560.0	0	0	0.0	0	0
70 - 75	1.5	5	169	-500,085	0	0	600.0	0	0	0.0	0	0
75 - 80	1.6	3	80	-533,424	0	0	640.0	0	0	0.0	0	0
80 - 85	1.7	0	5	-566,763	0	0	680.0	0	0	0.0	0	0
85 - 90	1.8	0	0	-600,102	0	0	720.0	0	0	0.0	0	0
90 - 95	1.9	0	0	-633,441	0	0	760.0	0	0	0.0	0	0
95 - 100	2.0	0	0	-666,780	0	0	800.0	100	3,432	0.0	0	0
Hours Off	0.0	0	5,684	0	0	7,264	0.0	0	5,328	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	6,769	32	1,080	4
Feb	6,036	29	711	4
March	6,026	32	100	2
April	4,968	29	0	0
May	5,656	30	0	0
June	5,825	30	0	0
July	5,652	30	0	0
Aug	6,196	30	0	0
Sept	5,396	30	0	0
Oct	5,498	29	0	0
Nov	5,529	29	135	2
Dec	6,535	32	631	3
Total	70,087	32	2,656	4

Building Energy Consumption = 28,951 (Btu/Sq Ft/Year)   Floor Area = 17,438 (Sq Ft)
Source Energy Consumption = 29,422 (Btu/Sq Ft/Year)

Σ monthly kW = 362

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**              T R A C E   6 0 0   A N A L Y S I S                       **
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ESOS STUDY AT WSMR - BUILDING 502
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 20:29:31 1/15/92
Dataset Name: 502 .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK *****

	Cooling Coil Peak					Clg Space Peak		Heating Coil Peak		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/19		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 91		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	12,236	0		12,236	4.97	14,284	6.33	-12,180	-12,180	3.69
Glass Solar	58,900	0		58,900	23.93	52,258	23.15	0	0	0.00
Glass Cond	40,825	0		40,825	16.59	32,057	14.20	-105,268	-105,268	31.88
Wall Cond	56,375	0		56,375	22.91	71,050	31.47	-101,661	-101,661	30.79
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-10,824	-10,824	3.28
Infiltration	0			0	0.00	0	0.00	-100,282	-100,282	30.37
Sub Total==>	168,335	0		168,335	68.41	169,649	75.14	-330,214	-330,214	100.00
Internal Loads										
Lights	32,209	0		32,209	13.09	52,179	23.11	0	0	0.00
People	5,040			5,040	2.05	3,956	1.75	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	37,249	0	0	37,249	15.14	56,135	24.86	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	40,501	16.46	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	[illegible]
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	205,584	0	0	246,085	100.00	225,784	100.00	-330,214	-330,214	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	39.0	467.6	466.8	13,100	81.4	58.7	49.9	60.0	44.1	24.7
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.0	467.6								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,583		
Part	15,907		
ExFlr	328		
Roof	6,291	0	0
Wall	8,354	1,900	23

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-490.4	13,100	55.2	94.3
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	13,100	60.0	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-490.4			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,380	0
Infil	0	2,380
Supply	13,100	13,100
Mincfm	0	0
Return	13,100	13,100
Exhaust	2,380	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	18.2
Clg Cfm/Sqft	1.04
Clg Cfm/Ton	336.16
Clg Sqft/Ton	322.89
Clg Btuh/Sqft	37.16
No. People	20
Htg % OA	0.0
Htg Cfm/SqFt	1.04
Htg Btuh/SqFt	-38.97

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	94.3
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	81.4	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 502

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	51.2	10.24
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	1.140	1.259	0.358	0.000	100.8	21.06
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	76.0	15.65
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	76.0	15.65
Building		0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	76.0	15.65

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 502

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
Building					12,583	15,907	328	0	0	6,291	1,900	23	6,454

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	1.9	9	228	-24,520	13	231	655.0	0	0	0.0	0	0
5 - 10	3.9	11	279	-49,041	11	198	1,310.0	0	0	0.0	0	0
10 - 15	5.8	13	325	-73,561	12	218	1,965.0	0	0	0.0	0	0
15 - 20	7.8	8	202	-98,081	8	146	2,620.1	0	0	0.0	0	0
20 - 25	9.7	9	241	-122,602	13	236	3,275.1	0	0	0.0	0	0
25 - 30	11.7	14	360	-147,122	12	223	3,930.1	0	0	0.0	0	0
30 - 35	13.6	12	312	-171,642	16	290	4,585.1	0	0	0.0	0	0
35 - 40	15.6	8	212	-196,162	9	169	5,240.1	0	0	0.0	0	0
40 - 45	17.5	13	326	-220,683	6	109	5,895.1	0	0	0.0	0	0
45 - 50	19.5	4	105	-245,203	1	10	6,550.1	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	0	7,205.1	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	7,860.2	0	0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	8,515.2	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	9,170.2	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	9,825.2	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	10,480.2	0	0	0.0	0	0
80 - 85	33.1	0	0	-416,845	0	0	11,135.2	0	0	0.0	0	0
85 - 90	35.1	0	0	-441,365	0	0	11,790.2	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	12,445.3	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	13,100.3	100	8,760	0.0	0	0
Hours Off	0.0	0	6,170	0	0	6,930	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	24,664	87
Feb	19,023	84
March	5,875	48
April	4,379	22
May	8,811	42
June	13,524	50
July	14,826	51
Aug	14,267	49
Sept	8,862	42
Oct	5,091	34
Nov	6,155	46
Dec	15,793	70
Total	141,270	87

Building Energy Consumption = 38,318 (Btu/Sq Ft/Year)   Floor Area = 12,583 (Sq Ft)
Source Energy Consumption = 38,318 (Btu/Sq Ft/Year)

Σ monthly kw = 625

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**              T R A C E    6 0 0    A N A L Y S I S                  **
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ESOS STUDY AT WSMR - BUILDING 502
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECO#9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17:27:47 1/20/92
Dataset Name: 502 .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>	Mo/Hr: 8/16					Mo/Hr: 7/19		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					OADB: 91		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	12,236	0		12,236	5.58	14,284	6.96	-12,180	-12,180	4.98
Glass Solar	68,336	0		68,336	31.16	55,116	26.85	0	0	0.00
Glass Cond	10,605	0		10,605	4.84	8,717	4.25	-26,623	-26,623	10.89
Wall Cond	55,424	0		55,424	25.27	71,050	34.61	-101,661	-101,661	41.57
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-10,824	-10,824	4.43
Infiltration	0			0	0.00	0	0.00	-93,262	-93,262	38.14
Sub Total==>	146,601	0		146,601	66.85	149,168	72.66	-244,550	-244,550	100.00
Internal Loads										
Lights	32,209	0		32,209	14.69	52,179	25.42	0	0	0.00
People	5,040			5,040	2.30	3,956	1.93	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	37,249	0	0	37,249	16.98	56,135	27.34	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	35,458	16.17	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	183,850	0	0	219,308	100.00	205,303	100.00	-244,550	-244,550	100.00

---------COOLING COIL SELECTION---------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	39.0	467.6	467.2	11,912	81.3	58.8	50.1	60.0	42.5	18.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.0	467.6								

---------AREAS---------

	Gross Total	Glass (sf)	(%)
Floor	12,583		
Part	15,907		
ExFlr	328		
Roof	6,291	0	0
Wall	8,354	1,900	23

---------HEATING COIL SELECTION---------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-490.4	11,912	46.4	89.4
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	11,912	59.8	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-490.4			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,214	0
Infil	0	2,214
Supply	11,912	11,912
Mincfm	0	0
Return	11,912	11,912
Exhaust	2,214	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	18.6
Clg Cfm/Sqft	0.95
Clg Cfm/Ton	305.67
Clg Sqft/Ton	322.89
Clg Btuh/Sqft	37.16
No. People	20
Htg % OA	0.0
Htg Cfm/SqFt	0.95
Htg Btuh/SqFt	-38.97

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	89.4
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	81.3	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 502

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	51.2	10.24
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.310	0.318	0.358	0.000	100.8	21.06
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	76.0	15.65
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	76.0	15.65
Building		0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	76.0	15.65

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 502

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
Building					12,583	15,907	328	0	0	6,291	1,900	23	6,454

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	1.9	13	371	-24,520	11	168	595.6	0	0	0.0	0	0
5 - 10	3.9	10	286	-49,041	11	173	1,191.2	0	0	0.0	0	0
10 - 15	5.8	12	348	-73,561	10	150	1,786.8	0	0	0.0	0	0
15 - 20	7.8	9	257	-98,081	12	183	2,382.4	0	0	0.0	0	0
20 - 25	9.7	11	304	-122,602	15	232	2,978.0	0	0	0.0	0	0
25 - 30	11.7	14	392	-147,122	9	143	3,573.6	0	0	0.0	0	0
30 - 35	13.6	12	336	-171,642	19	301	4,169.2	0	0	0.0	0	0
35 - 40	15.6	12	348	-196,162	8	127	4,764.8	0	0	0.0	0	0
40 - 45	17.5	7	193	-220,683	5	70	5,360.4	0	0	0.0	0	0
45 - 50	19.5	0	0	-245,203	0	0	5,956.0	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	0	6,551.5	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	7,147.1	0	0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	7,742.7	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	8,338.3	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	8,933.9	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	9,529.5	0	0	0.0	0	0
80 - 85	33.1	0	0	-416,845	0	0	10,125.1	0	0	0.0	0	0
85 - 90	35.1	0	0	-441,365	0	0	10,720.7	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	11,316.3	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	11,911.9	100	8,760	0.0	0	0
Hours Off	0.0	0	5,925	0	0	7,213	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	21,938	67
Feb	16,616	64
March	5,578	46
April	4,379	29
May	8,955	41
June	13,038	47
July	14,164	48
Aug	13,924	47
Sept	9,203	41
Oct	5,237	35
Nov	5,654	46
Dec	13,711	52
Total	132,399	67

ding Energy Consumption = 35,912 (Btu/Sq Ft/Year)   Floor Area = 12,583 (Sq Ft)
e Energy Consumption = 35,912 (Btu/Sq Ft/Year)

Σ monthly kW = 563

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**            T R A C E   6 0 0   A N A L Y S I S                          **
**                                                                          **
**            by            **
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ESOS STUDY AT WSMR - BUILDING 502
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (GREY) (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17:45:47 1/20/92
Dataset Name: 502 .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

	COOLING COIL PEAK		CLG SPACE PEAK	HEATING COIL PEAK
Peaked at Time ==>	Mo/Hr: 7/17	*	Mo/Hr: 7/19 *	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0	*	OADB: 91 *	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	12,236	0		12,236	6.30	14,284	7.70	-12,180	-12,180	4.97
Glass Solar	39,900	0		39,900	20.55	35,158	18.95	0	0	0.00
Glass Cond	11,328	0		11,328	5.83	8,872	4.78	-27,095	-27,095	11.06
Wall Cond	56,375	0		56,375	29.03	71,050	38.30	-101,661	-101,661	41.49
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-10,824	-10,824	4.42
Infiltration	0			0	0.00	0	0.00	-93,262	-93,262	38.06
Sub Total==>	119,839	0		119,839	61.72	129,364	69.74	-245,022	-245,022	100.00
Internal Loads										
Lights	32,209	0		32,209	16.59	52,179	28.13	0	0	0.00
People	5,040			5,040	2.60	3,956	2.13	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	37,249	0	0	37,249	19.18	56,135	30.26	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	37,077	19.10	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	[illegible]
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	157,088	0	0	194,165	100.00	185,499	100.00	-245,022	-245,022	100.00

----------------------------------COOLING COIL SELECTION------------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	39.0	467.6	467.6	10,763	81.8	59.0	50.2	60.0	40.7	12.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.0	467.6								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,583		
Part	15,907		
ExFlr	328		
Roof	6,291	0	0
Wall	8,354	1,900	23

------------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-490.4	10,763	44.2	91.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	10,763	59.0	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-490.4			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,214	0
Infil	0	2,214
Supply	10,763	10,763
Mincfm	0	0
Return	10,763	10,763
Exhaust	2,214	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	20.6
Clg Cfm/Sqft	0.86
Clg Cfm/Ton	276.18
Clg Sqft/Ton	322.89
Clg Btuh/Sqft	37.16
No. People	20
Htg % OA	0.0
Htg Cfm/SqFt	0.86
Htg Btuh/SqFt	-38.97

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	91.8
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	81.8	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG. 502

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.315	0.324	0.358	0.000	51.2	10.24
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.315	0.324	0.358	0.000	100.8	21.06
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.315	0.324	0.358	0.000	76.0	15.65
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.315	0.324	0.358	0.000	76.0	15.65
Building		0.388	0.750	0.000	0.000	0.044	0.315	0.324	0.358	0.000	76.0	15.65

BUILDING AREAS - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG. 502

---------------------------------- B U I L D I N G   A R E A S ----------------------------------

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
Building					12,583	15,907	328	0	0	6,291	1,900	23	6,454

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	1.9	12	316	-24,520	16	297	538.1	0	0	0.0	0	0
5 - 10	3.9	13	355	-49,041	12	216	1,076.3	0	0	0.0	0	0
10 - 15	5.8	13	344	-73,561	10	184	1,614.4	0	0	0.0	0	0
15 - 20	7.8	10	272	-98,081	9	154	2,152.6	0	0	0.0	0	0
20 - 25	9.7	13	353	-122,602	14	254	2,690.7	0	0	0.0	0	0
25 - 30	11.7	17	473	-147,122	11	193	3,228.9	0	0	0.0	0	0
30 - 35	13.6	9	243	-171,642	17	310	3,767.0	0	0	0.0	0	0
35 - 40	15.6	13	349	-196,162	7	127	4,305.2	0	0	0.0	0	0
40 - 45	17.5	1	40	-220,683	4	70	4,843.3	0	0	0.0	0	0
45 - 50	19.5	0	0	-245,203	0	0	5,381.4	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	0	5,919.6	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	6,457.7	0	0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	6,995.9	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	7,534.0	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	8,072.2	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	8,610.3	0	0	0.0	0	0
80 - 85	33.1	0	0	-416,845	0	0	9,148.5	0	0	0.0	0	0
85 - 90	35.1	0	0	-441,365	0	0	9,686.6	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	10,224.7	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	10,762.9	100	8,760	0.0	0	0
Hours Off	0.0	0	6,015	0	0	6,955	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	23,000	67
Feb	17,560	64
March	5,737	46
April	4,379	21
May	8,700	39
June	12,456	45
July	13,553	45
Aug	13,310	44
Sept	8,591	39
Oct	5,115	32
Nov	5,846	46
Dec	14,564	52
Total	132,812	67

Building Energy Consumption = 36,024 (Btu/Sq Ft/Year)   Floor Area = 12,583 (Sq Ft)
Source Energy Consumption = 36,024 (Btu/Sq Ft/Year)

Σ monthly KW= 540

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**               T R A C E   6 0 0   A N A L Y S I S                       **
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**               by             **
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ESOS STUDY AT WSMR - BUILDING 502
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO #9) (BRONZE)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 3:48 1/20/92
Dataset Name: 502 .TM

System 1 Peak INCHP - INCREMENTAL HEAT PUMP

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK *****

	COOLING COIL PEAK						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/17						Mo/Hr: 7/19			Mo/Hr: 13/ 1	
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0						OADB: 91			OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot		Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)		(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00		0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00		0	0.00	0	0	0.00
Roof Cond	12,236	0		12,236	6.30		14,284	7.70	-12,180	-12,180	4.97
Glass Solar	39,900	0		39,900	20.55		35,158	18.95	0	0	0.00
Glass Cond	11,330	0		11,330	5.84		8,873	4.78	-27,099	-27,099	11.06
Wall Cond	56,375	0		56,375	29.03		71,050	38.30	-101,661	-101,661	41.49
Partition	0			0	0.00		0	0.00	0	0	0.00
Exposed Floor	0			0	0.00		0	0.00	-10,824	-10,824	4.42
Infiltration	0			0	0.00		0	0.00	-93,262	-93,262	38.06
Sub Total==>	119,840	0		119,840	61.72		129,366	69.74	-245,026	-245,026	100.00
Internal Loads											
Lights	32,209	0		32,209	16.59		52,179	28.13	0	0	0.00
People	5,040			5,040	2.60		3,956	2.13	0	0	0.00
Misc	0	0	0	0	0.00		0	0.00	0	0	0.00
Sub Total==>	37,249	0	0	37,249	19.18		56,135	30.26	0	0	0.00
Ceiling Load	0	0		0	0.00		0	0.00	0	0	0.00
Outside Air	0	0	0	37,077	19.10		0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00			0.00		0	0.00
Ret. Fan Heat		0		0	0.00			0.00		0	0.00
Duct Heat Pkup		0		0	0.00			0.00		0	0.00
OV/UNDR Sizing	0			0	0.00		0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00			0.00		0	0.00
Terminal Bypass		0	0	0	0.00			0.00		0	0.00
Grand Total==>	157,090	0	0	194,166	100.00		185,501	100.00	-245,026	-245,026	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	39.0	467.6	467.6	10,763	81.8	59.0	50.2	60.0	40.7	12.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.0	467.6								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,583		
Part	15,907		
ExFlr	328		
Roof	6,291	0	0
Wall	8,354	1,900	23

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-490.4	10,763	44.2	91.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	10,763	59.0	60.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-490.4			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,214	0
Infil	0	2,214
Supply	10,763	10,763
Mincfm	0	0
Return	10,763	10,763
Exhaust	2,214	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	20.6
Clg Cfm/Sqft	0.86
Clg Cfm/Ton	276.19
Clg Sqft/Ton	322.89
Clg Btuh/Sqft	37.16
No. People	20
Htg % OA	0.0
Htg Cfm/SqFt	0.86
Htg Btuh/SqFt	-38.97

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.0	91.8
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	81.8	68.0
Runarnd	78.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG. 502

B U I L D I N G   U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.316	0.324	0.358	0.000	51.2	10.24
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.316	0.324	0.358	0.000	100.8	21.06
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.316	0.324	0.358	0.000	76.0	15.65
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.316	0.324	0.358	0.000	76.0	15.65
Building		0.388	0.750	0.000	0.000	0.044	0.316	0.324	0.358	0.000	76.0	15.65

BUILDING AREAS - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG. 502

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
Building					12,583	15,907	328	0	0	6,291	1,900	23	6,454

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 4

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	1.9	12	316	-24,520	16	297	538.1	0	0	0.0	0	0
5 - 10	3.9	13	355	-49,041	12	216	1,076.3	0	0	0.0	0	0
10 - 15	5.8	13	344	-73,561	10	184	1,614.4	0	0	0.0	0	0
15 - 20	7.8	10	272	-98,081	9	154	2,152.6	0	0	0.0	0	0
20 - 25	9.7	13	353	-122,602	14	254	2,690.7	0	0	0.0	0	0
25 - 30	11.7	17	473	-147,122	11	193	3,228.9	0	0	0.0	0	0
30 - 35	13.6	9	243	-171,642	17	310	3,767.0	0	0	0.0	0	0
35 - 40	15.6	13	349	-196,162	7	127	4,305.2	0	0	0.0	0	0
40 - 45	17.5	1	40	-220,683	4	70	4,843.3	0	0	0.0	0	0
45 - 50	19.5	0	0	-245,203	0	0	5,381.5	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	0	5,919.6	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	6,457.8	0	0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	6,995.9	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	7,534.1	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	8,072.2	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	8,610.4	0	0	0.0	0	0
80 - 85	33.1	0	0	-416,845	0	0	9,148.5	0	0	0.0	0	0
85 - 90	35.1	0	0	-441,365	0	0	9,686.7	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	10,224.8	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	10,763.0	100	8,760	0.0	0	0
Hours Off	0.0	0	6,015	0	0	6,955	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 4

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	23,000	67
Feb	17,560	64
March	5,737	46
April	4,379	21
May	8,700	39
June	12,456	45
July	13,553	45
Aug	13,310	44
Sept	8,591	39
Oct	5,115	32
Nov	5,846	46
Dec	14,564	52
Total	132,812	67

Building Energy Consumption = 36,024 (Btu/Sq Ft/Year) Floor Area = 12,583 (Sq Ft)
Source Energy Consumption = 36,024 (Btu/Sq Ft/Year)

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**                                                                         **
**              T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                         **
**              by             **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 503
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC. ✓
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO #9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:27:20 1/10/92
Dataset Name: 503 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK *****

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-58,679	-58,679	12.90
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-150,308	-150,308	33.03
Wall Cond	0	0		0	0.00	0	0.00	-137,622	-137,622	30.24
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-13,767	-13,767	3.03
Infiltration	0			0	0.00	0	0.00	-94,661	-94,661	20.80
Sub Total==>	0	0		0	0.00	0	0.00	-455,036	-455,036	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-455,036	-455,036	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	14,496		
Part	11,708		
ExFlr	417		
Roof	7,248	0	0
Wall	11,450	2,713	24

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-530.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-530.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	2,247
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-36.56

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 503

B U I L D I N G U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	48.3	9.66
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.184	1.140	1.259	0.358	0.000	99.8	20.85
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.0	15.25
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.0	15.25
Building		0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.0	15.25

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 503

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	7,248	7,248	5,854	417	0	0	0	1,356	24	4,368
2	2ND FLOOR	1	1	7,248	7,248	5,854	0	0	0	7,248	1,356	24	4,368
Zone	1 Total/Ave.				14,496	11,708	417	0	0	7,248	2,713	24	8,737
System	1 Total/Ave.				14,496	11,708	417	0	0	7,248	2,713	24	8,737
Building					14,496	11,708	417	0	0	7,248	2,713	24	8,737

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-26,501	15	321	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-53,001	15	310	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-79,501	9	185	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-106,002	13	277	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-132,503	6	117	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-159,003	10	209	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-185,504	9	196	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-212,004	12	243	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-238,505	7	153	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-265,005	4	93	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-291,506	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-318,006	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-344,507	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-371,007	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-397,508	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-424,008	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-450,509	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-477,009	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-503,510	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-530,010	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,656	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	4,851	23	1,075	4
Feb	4,351	23	819	4
March	4,661	23	188	2
April	3,984	22	0	0
May	4,330	22	0	0
June	4,303	22	0	0
July	4,010	22	0	0
Aug	4,489	22	0	0
Sept	3,984	22	0	0
Oct	4,330	22	0	0
Nov	4,243	23	193	2
Dec	4,574	23	699	3
Total	52,110	23	2,975	4

Building Energy Consumption = 32,791 (Btu/Sq Ft/Year)   Floor Area = 14,496 (Sq Ft)
Source Energy Consumption = 33,425 (Btu/Sq Ft/Year)

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**                 T R A C E   6 0 0   A N A L Y S I S                       **
**                                                                           **
**                 by            **
**                                                                           **
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ESOS STUDY AT WSMR - BUILDING 503
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO <CLEAR>

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)
Design Simulation Period:	May	To October
System Simulation Period:	January	To December
Cooling Load Methodology:	TETD/Time Averaging	
Time/Date Program was Run:	15:21:10	1/17/92
Dataset Name:	503 .TM	

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ***

						*			*			
Peaked at Time ==>		Mo/Hr: 0/ 0				*	Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				*	OADB: 0		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-58,679	-58,679	17.46
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-38,014	-38,014	11.31
Wall Cond	0	0		0	0.00	*	0	0.00	*	-137,622	-137,622	40.94
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-13,767	-13,767	4.10
Infiltration	0			0	0.00	*	0	0.00	*	-88,034	-88,034	26.19
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-336,116	-336,116	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	[illegible]
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-336,116	-336,116	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	14,496		
Part	11,708		
ExFlr	417		
Roof	7,248	0	0
Wall	11,450	2,713	24

------------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-530.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-530.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	2,090
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-36.56

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 503

--------------------------------- B U I L D I N G   U - V A L U E S ---------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	48.3	9.66
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.184	0.310	0.318	0.358	0.000	99.8	20.85
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.0	15.25
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.0	15.25
Building		0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.0	15.25

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 503

--------------------------------- B U I L D I N G   A R E A S ---------------------------------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	7,248	7,248	5,854	417	0	0	0	1,356	24	4,368
2	2ND FLOOR	1	1	7,248	7,248	5,854	0	0	0	7,248	1,356	24	4,368
Zone	1 Total/Ave.				14,496	11,708	417	0	0	7,248	2,713	24	8,737
System	1 Total/Ave.				14,496	11,708	417	0	0	7,248	2,713	24	8,737
Building					14,496	11,708	417	0	0	7,248	2,713	24	8,737

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-26,501	15	289	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-53,001	17	315	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-79,501	12	223	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-106,002	8	148	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-132,503	11	212	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-159,003	12	219	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-185,504	8	155	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-212,004	7	128	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-238,505	9	177	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-265,005	1	10	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-291,506	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-318,006	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-344,507	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-371,007	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-397,508	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-424,008	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-450,509	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-477,009	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-503,510	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-530,010	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,884	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	4,775	23	912	3
Feb	4,311	23	676	3
March	4,619	23	131	2
April	3,984	22	0	0
May	4,330	22	0	0
June	4,303	22	0	0
July	4,010	22	0	0
Aug	4,489	22	0	0
Sept	3,984	22	0	0
Oct	4,330	22	0	0
Nov	4,207	23	147	2
Dec	4,565	23	568	2
Total	51,907	23	2,433	3

Building Energy Consumption = 29,007 (Btu/Sq Ft/Year)   Floor Area = 14,496 (Sq Ft)
Source Energy Consumption = 29,526 (Btu/Sq Ft/Year)

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**            T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                        **
**            by           **
**                                                                        **
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ESOS STUDY AT WSMR - BUILDING 504
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO# 9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17: 9:34 1/10/92
Dataset Name: 504 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ****

	Cooling Coil Peak	CLG Space Peak	Heating Coil Peak
Peaked at Time ==>	Mo/Hr: 0/ 0	Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-48,568	-48,568	12.85
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-121,587	-121,587	32.17
Wall Cond	0	0		0	0.00	0	0.00	-117,299	-117,299	31.03
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-12,185	-12,185	3.22
Infiltration	0			0	0.00	0	0.00	-78,350	-78,350	20.73
Sub Total==>	0	0		0	0.00	0	0.00	-377,989	-377,989	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-377,989	-377,989	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	11,998		
Part	9,412		
ExFlr	369		
Roof	5,999	0	0
Wall	9,641	2,195	23

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-439.5	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-439.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,860
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-36.63

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 504

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	48.7	9.75
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.184	1.140	1.259	0.358	0.000	100.2	20.94
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.5	15.34
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.5	15.34
Building		0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.5	15.34

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 504

---------------------------------- B U I L D I N G   A R E A S ----------------------------------

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	5,999	5,999	4,706	369	0	0	0	1,097	23	3,723
2	2ND FLOOR	1	1	5,999	5,999	4,706	0	0	0	5,999	1,097	23	3,723
Zone	1 Total/Ave.				11,998	9,412	369	0	0	5,999	2,195	23	7,447
System	1 Total/Ave.				11,998	9,412	369	0	0	5,999	2,195	23	7,447
Building					11,998	9,412	369	0	0	5,999	2,195	23	7,447

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
Design Load	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-21,973	14	283	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-43,947	13	263	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-65,920	12	244	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-87,894	10	202	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-109,867	10	199	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-131,841	8	160	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-153,815	11	219	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-175,788	11	212	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-197,762	8	156	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-219,735	4	81	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-241,709	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-263,682	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-285,656	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-307,629	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-329,603	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-351,576	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-373,550	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-395,523	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-417,497	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-439,470	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,741	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	4,065	19	876	3
Feb	3,653	19	668	3
March	3,870	19	157	2
April	3,297	18	0	0
May	3,584	18	0	0
June	3,562	18	0	0
July	3,319	18	0	0
Aug	3,716	18	0	0
Sept	3,297	18	0	0
Oct	3,584	18	0	0
Nov	3,616	19	149	2
Dec	3,877	19	561	3
Total	43,439	19	2,411	3

Building Energy Consumption = 32,451 (Btu/Sq Ft/Year)   Floor Area = 11,998 (Sq Ft)
Source Energy Consumption = 33,072 (Btu/Sq Ft/Year)

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

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**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by              **                                            **
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ESOS STUDY AT WSMR - BUILDING 504
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECO#9)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:48:43 1/17/92
Dataset Name: 504 .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Block RAD - RADIATION

	COOLING COIL PEAK						CLG SPACE PEAK			HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-48,568	-48,568	17.24
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-30,750	-30,750	10.92
Wall Cond	0	0		0	0.00	*	0	0.00	*	-117,299	-117,299	41.64
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-12,185	-12,185	4.33
Infiltration	0			0	0.00	*	0	0.00	*	-72,865	-72,865	25.87
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-281,668	-281,668	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-281,668	-281,668	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	11,998		
Part	9,412		
ExFlr	369		
Roof	5,999	0	0
Wall	9,641	2,195	23

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-439.5	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-439.5			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	1,730
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-36.63

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.C

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 504

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	48.7	9.75
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.184	0.310	0.318	0.358	0.000	100.2	20.94
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.5	15.34
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.5	15.34
Building		0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.5	15.34

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 504

-------------------------------- B U I L D I N G   A R E A S --------------------------------

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	5,999	5,999	4,706	369	0	0	0	1,097	23	3,723
2	2ND FLOOR	1	1	5,999	5,999	4,706	0	0	0	5,999	1,097	23	3,723
Zone	1 Total/Ave.				11,998	9,412	369	0	0	5,999	2,195	23	7,447
System	1 Total/Ave.				11,998	9,412	369	0	0	5,999	2,195	23	7,447
Building					11,998	9,412	369	0	0	5,999	2,195	23	7,447

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-21,973	14	259	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-43,947	16	291	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-65,920	12	222	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-87,894	8	137	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-109,867	14	244	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-131,841	11	197	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-153,815	7	132	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-175,788	7	128	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-197,762	10	177	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-219,735	1	10	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-241,709	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-263,682	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-285,656	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-307,629	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-329,603	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-351,576	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-373,550	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-395,523	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-417,497	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-439,470	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,963	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	4,035	19	743	3
Feb	3,616	19	552	2
March	3,828	19	103	2
April	3,297	18	0	0
May	3,584	18	0	0
June	3,562	18	0	0
July	3,319	18	0	0
Aug	3,716	18	0	0
Sept	3,297	18	0	0
Oct	3,584	18	0	0
Nov	3,581	19	107	2
Dec	3,731	19	453	2
Total	43,149	19	1,958	3

Building Energy Consumption = 28,596 (Btu/Sq Ft/Year)   Floor Area = 11,998 (Sq Ft)
Source Energy Consumption = 29,100 (Btu/Sq Ft/Year)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P102-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$7,820	
B. SIOH COST	(5.5% of 1A) =		$430	
C. DESIGN COST	(6.0% of 1A) =		$469	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$8,719	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$8,719

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(15)	($98)	15.23	($1,489)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	49	$108	19.64	$2,112	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		34	9.8		————>	$623

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$206	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$10
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$623
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.07
7 SIMPLE PAYBACK (SPB)	(1F/4) =	891.61

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P124-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/15/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$16,158	
B. SIOH COST		(5.5% of 1A) =	$889	
C. DESIGN COST		(6.0% of 1A) =	$969	
D. ENERGY CREDIT		(1A + 1B + 1C) =	$18,016	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT		(1D – 1E) =	————>	$18,016

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(14)	($92)	15.23	($1,400)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	50	$111	19.64	$2,187	
D. PAPER		0	$0		$0	
E. COAL		0	$0	16.22	$0	
F. TOTAL		36	19.4		————>	$787

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $260

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$19
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$787
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.04
7	SIMPLE PAYBACK (SPB)	(1F/4) =	927.37

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P153-ELECTRIC DHW HEATERS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$2,314	
B. SIOH COST	(5.5% of 1A) =		$127	
C. DESIGN COST	(6.0% of 1A) =		$139	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$2,580	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		------------>	$2,580

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(3)	($18)	15.23	($273)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	13	$29	19.64	$561	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		10	10.6		------------>	$288

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $95

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$11
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$288
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.11
7 SIMPLE PAYBACK (SPB)	(1F/4) =	243.13

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P254-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$4,628	
B. SIOH COST	(5.5% of 1A) =		$255	
C. DESIGN COST	(6.0% of 1A) =		$278	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$5,160	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$5,160

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(7)	($47)	15.23	($714)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	26	$57	19.64	$1,112	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		18	9.8		————>	$398

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$131	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$10
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$398
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.08
7 SIMPLE PAYBACK (SPB)	(1F/4) =	529.16

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P260-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$3,830	
B. SIOH COST	(5.5% of 1A) =		$211	
C. DESIGN COST	(6.0% of 1A) =		$230	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$4,270	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$4,270

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(5)	($35)	15.23	($533)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	17	$38	19.64	$747	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		12	3.1		————>	$215

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0
1 DISCOUNT FACTOR	(From Table A-2) =	14.68	
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$71	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$3
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$215
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	0.05
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	1382.79

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-ELECTRIC DHW HEATERS-BLDG 300			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/09/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$20,826		
B. SIOH COST	(5.5% of 1A) =	$1,145		
C. DESIGN COST	(6.0% of 1A) =	$1,250		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$23,221		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$23,221	

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(38)	($244)	15.23	($3,711)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	116	$257	19.64	$5,053	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		79	13.6		————>	$1,342

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) = $0

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $443

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$14
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,342
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.06
7 SIMPLE PAYBACK (SPB)	(1F/4) =	1704.07

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P380-ELECTRIC DHW HEATERS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$7,620	
B. SIOH COST	(5.5% of 1A) =		$419	
C. DESIGN COST	(6.0% of 1A) =		$457	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$8,496	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$8,496

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(1)	($6)	15.23	($91)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	12	$27	19.64	$533	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		11	21.2		————>	$443

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0
1 DISCOUNT FACTOR	(From Table A-2) =	14.68	
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $146

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$21
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$443
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.05
7 SIMPLE PAYBACK (SPB)	(1F/4) =	400.83

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P464-ELECTRIC DHW HEATERS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$4,588	
B. SIOH COST	(5.5% of 1A) =		$252	
C. DESIGN COST	(6.0% of 1A) =		$275	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$5,116	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$5,116

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(6)	($42)	15.23	($638)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	16	$34	19.64	$675	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		9	(7.5)		————>	$37

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) = $0

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $12

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–) (2F3 + 3A + (3B1d/25)) = ($8)

5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = $37

6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.01

(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)

7 SIMPLE PAYBACK (SPB) (1F/4) = -681.79

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P1504-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$3,830		
B. SIOH COST	(5.5% of 1A) =	$211		
C. DESIGN COST	(6.0% of 1A) =	$230		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$4,270		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D − 1E) =	————>	$4,270	

2 ENERGY SAVINGS (+) / COST (−)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(15)	($100)	15.23	($1,520)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	43	$95	19.64	$1,875	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		28	(4.3)		————>	$356

3 NON-ENERGY SAVINGS (+) / COST (−)

A. ANNUAL RECURRING (+/−)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (−)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/−)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (−)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$117	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (−)	(2F3 + 3A + (3B1d/25)) =	($4)
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$356
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.08
7 SIMPLE PAYBACK (SPB)	(1F/4) =	-995.72

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range	REGION: 4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P1506-ELECTRIC DHW HEATERS		FISCAL YEAR:	1992
DISCRETE PORTION NAME: TOTAL			
ANALYSIS DATE: 06/04/92	ECONOMIC LIFE: 25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$9,176	
B. SIOH COST	(5.5% of 1A) =		$505	
C. DESIGN COST	(6.0% of 1A) =		$551	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$10,231	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$10,231

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(20)	($129)	15.23	($1,962)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	106	$235	19.64	$4,615	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		86	106.1		————>	$2,652

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$875	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$106
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$2,652
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.26
7 SIMPLE PAYBACK (SPB)	(1F/4) =	96.43

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P1512-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$8,458	
B. SIOH COST	(5.5% of 1A) =		$465	
C. DESIGN COST	(6.0% of 1A) =		$507	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$9,431	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		——————>	$9,431

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(3)	($17)	15.23	($258)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	40	$89	19.64	$1,739	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		37	71.6		——————>	$1,480

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$488	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$72
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,480
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.16
7 SIMPLE PAYBACK (SPB)	(1F/4) =	131.80

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range | REGION: 4 | PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P1526-ELECTRIC DHW HEATERS | FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92 | ECONOMIC LIFE: 25 | PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$6,104		
B. SIOH COST	(5.5% of 1A) =	$336		
C. DESIGN COST	(6.0% of 1A) =	$366		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$6,806		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$6,806	

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(15)	($100)	15.23	($1,520)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	22	$49	19.64	$960	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		7	(50.9)		————>	($559)

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) = $0
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = ($185)
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	($51)
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	($559)
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	–0.08
7 SIMPLE PAYBACK (SPB)	(1F/4) =	–133.75

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P1528-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$6,234	
B. SIOH COST	(5.5% of 1A) =		$343	
C. DESIGN COST	(6.0% of 1A) =		$374	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$6,951	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$6,951

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(15)	($100)	15.23	($1,520)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	49	$108	19.64	$2,119	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		33	8.1		————>	$599

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$198	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$8
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$599
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.09
7 SIMPLE PAYBACK (SPB)	(1F/4) =	857.71

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P1530-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$12,408	
B. SIOH COST	(5.5% of 1A) =		$682	
C. DESIGN COST	(6.0% of 1A) =		$744	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$13,835	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$13,835

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(35)	($225)	15.23	($3,420)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	80	$178	19.64	$3,491	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		46	(46.8)		————>	$71

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$23	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	($47)
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$71
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.01
7 SIMPLE PAYBACK (SPB)	(1F/4) =	-295.59

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10- 1558-ELECTRIC DHW HEATERS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$7,666	
B. SIOH COST	(5.5% of 1A)	=	$422	
C. DESIGN COST	(6.0% of 1A)	=	$460	
D. ENERGY CREDIT	(1A + 1B + 1C)	=	$8,548	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D − 1E)	=	————>	$8,548

2 ENERGY SAVINGS (+) / COST (−)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(11)	($71)	15.23	($1,079)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	26	$58	19.64	$1,136	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		15	(13.0)		————>	$57

3 NON-ENERGY SAVINGS (+) / COST (−)

A. ANNUAL RECURRING (+/−) = $0

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (−) (3A x 3A1) = $0

B. NON-RECURRING (+/−)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (−) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $19

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (−) (2F3 + 3A + (3B1d/25)) = ($13)

5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = $57

6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.01

(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)

7 SIMPLE PAYBACK (SPB) (1F/4) = −658.08

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P1621-ELECTRIC DHW HEATERS   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/04/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$2,314	
B. SIOH COST	(5.5% of 1A)	=	$127	
C. DESIGN COST	(6.0% of 1A)	=	$139	
D. ENERGY CREDIT	(1A + 1B + 1C)	=	$2,580	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D - 1E)	=	----------->	$2,580

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(394)	($2,552)	15.23	($38,864)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	606	$1,342	19.64	$26,352	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		212	(1,210.1)		----------->	($12,512)

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)	=		$0
1 DISCOUNT FACTOR	(From Table A-2) =	14.68	
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	($4,129)	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	($6)	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	($1,210)
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	($12,512)
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	-4.85
7 SIMPLE PAYBACK (SPB)	(1F/4) =	-2.13

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range		REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P1622-ELECTRIC DHW HEATERS				FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$12,378	
B. SIOH COST	(5.5% of 1A) =		$681	
C. DESIGN COST	(6.0% of 1A) =		$743	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$13,801	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$13,801

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(15)	($100)	15.23	($1,520)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	60	$132	19.64	$2,589	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		44	32.0		————>	$1,069

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$353	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$32
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,069
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.08
7 SIMPLE PAYBACK (SPB)	(1F/4) =	430.64

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P1624-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/04/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$10,892	
B. SIOH COST	(5.5% of 1A) =		$599	
C. DESIGN COST	(6.0% of 1A) =		$654	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$12,145	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		———>	$12,145

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(20)	($130)	15.23	($1,972)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	59	$131	19.64	$2,576	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		39	1.6		———>	$603

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$199	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$2
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$603
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	0.05
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	7394.50

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10-P1751-ELECTRIC DHW HEATERS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$2,324	
B. SIOH COST	(5.5% of 1A) =		$128	
C. DESIGN COST	(6.0% of 1A) =		$139	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$2,591	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		---------->	$2,591

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(2)	($13)	15.23	($196)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	23	$51	19.64	$1,010	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		21	38.5		---------->	$813

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $268

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$39
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$813
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.31
7 SIMPLE PAYBACK (SPB)	(1F/4) =	67.26

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-P1753-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	03/18/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$2,314	
B. SIOH COST	(5.5% of 1A) =		$127	
C. DESIGN COST	(6.0% of 1A) =		$139	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$2,580	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		———————>	$2,580

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(3)	($17)	15.23	($258)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	12	$27	19.64	$535	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		10	10.3		———————>	$277

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$91	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$10
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$277
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.11
7 SIMPLE PAYBACK (SPB)	(1F/4) =	251.23

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range — REGION: 4 — PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #10-S1790-ELECTRIC DHW HEATERS — FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/09/92 — ECONOMIC LIFE: 25 — PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$2,334	
B. SIOH COST	(5.5% of 1A) =	$128	
C. DESIGN COST	(6.0% of 1A) =	$140	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$2,602	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$2,602

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(3)	($17)	15.23	($258)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	32	$70	19.64	$1,372	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		29	52.9		————>	$1,113

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0
1 DISCOUNT FACTOR	(From Table A–2) =	14.68	
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) — (3A2 + 3Bd4) = — $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION — (2F5 x 0.33) = — $367

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR — (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$53
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,113
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.43
7 SIMPLE PAYBACK (SPB)	(1F/4) =	49.22

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #10-S1794-ELECTRIC DHW HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/09/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$12,374	
B. SIOH COST	(5.5% of 1A) =		$681	
C. DESIGN COST	(6.0% of 1A) =		$742	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$13,797	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		------------>	$13,797

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(5)	($31)	15.23	($471)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	18	$41	19.64	$800	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		14	9.8		------------>	$329

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)	=		$0
1 DISCOUNT FACTOR	(From Table A-2) =	14.68	
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $108

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$10
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$329
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.02
7 SIMPLE PAYBACK (SPB)	(1F/4) =	1410.69

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) DOMESTIC HOT WATER HEATERS	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER
WORK LOCATION	WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	BUILDING 102									
	APPURTENANCES	EA	10	LABOR AND MATERIALS 488	4880					$4,880.00
	1.5 KW	EA	4	280	1120					$1,120.00
	2.5 KW	EA	4	300	1200					$1,200.00
	3.0 KW	EA	2	310	620					$620.00
	TOTAL									$7,820.00
2	BUILDING 124									
	APPURTENANCES	EA	21	LABOR AND MATERIALS 488	10248					$10,248.00
	1.5 KW	EA	15	270	4050					$4,050.00
	3.0 KW	EA	6	310	1860					$1,860.00
	TOTAL									$16,158.00
3	BUILDING 153									
	APPURTENANCES	EA	3	LABOR AND MATERIALS 488	1464					$1,464.00
	1.0 KW	EA	2	270	540					$540.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$2,314.00

Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): DOMESTIC HOT WATER HEATERS	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
4	BUILDING 254									
	APPURTENANCES	EA	6	LABOR AND MATERIALS 488	2928					$2,928.00
	1.0 KW	EA	4	270	1080					$1,080.00
	3.0 KW	EA	2	310	620					$620.00
	TOTAL									$4,628.00
5	BUILDING 260									
	APPURTENANCES	EA	5	LABOR AND MATERIALS 488	2440					$2,440.00
	1.0 KW	EA	4	270	1080					$1,080.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$3,830.00
6	BUILDING 300E									
	APPURTENANCES	EA	9	LABOR AND MATERIALS 488	4392					$4,392.00
	1.0 KW	EA	6	270	1620					$1,620.00
	3.0 KW	EA	3	310	930					$930.00
	TOTAL									$6,942.00

Ma[illegible] Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Sour[illegible]ans Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): DOMESTIC HOT WATER HEATERS

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
7	BUILDING 300S									
	APPURTENANCES	EA	9	LABOR AND MATERIALS 488	4392					$4,392.00
	1.0 KW	EA	6	270	1620					$1,620.00
	3.0 KW	EA	3	310	930					$930.00
	TOTAL									$6,942.00
8	BUILDING 300W									
	APPURTENANCES	EA	9	LABOR AND MATERIALS 488	4392					$4,392.00
	1.0 KW	EA	6	270	1620					$1,620.00
	3.0 KW	EA	3	310	930					$930.00
	TOTAL									$6,942.00
9	BUILDING 380									
	APPURTENANCES	EA	10	LABOR AND MATERIALS 488	4880					$4,880.00
	1.0 KW	EA	9	270	2430					$2,430.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$7,620.00

Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) DOMESTIC HOT WATER HEATERS	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER
WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
10	BUILDING 1504									
	APPURTENANCES	EA	5	LABOR AND MATERIALS 488	2440					$2,440.00
	1.0 KW	EA	4	270	1080					$1,080.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$3,830.00
11	BUILDING 1506									
	APPURTENANCES	EA	12	LABOR AND MATERIALS 488	5856					$5,856.00
	1.0 KW	EA	10	270	2700					$2,700.00
	3.0 KW	EA	2	310	620					$620.00
	TOTAL									$9,176.00
12	BUILDING 1512									
	APPURTENANCES	EA	11	LABOR AND MATERIALS 488	5368					$5,368.00
	1.0 KW	EA	8	270	2160					$2,160.00
	3.0 KW	EA	3	310	930					$930.00
	TOTAL									$8,458.00

Mate[illegible]rce: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source[illegible] Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): DOMESTIC HOT WATER HEATERS	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
13	BUILDING 1526									
	APPURTENANCES	EA	8	LABOR AND MATERIALS 488	3904					$3,904.00
	1.0 KW	EA	7	270	1890					$1,890.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$6,104.00
14	BUILDING 1528									
	APPURTENANCES	EA	8	LABOR AND MATERIALS 488	3904					$3,904.00
	1.0 KW	EA	3	270	810					$810.00
	1.5 KW	EA	1	280	280					$280.00
	3.0 KW	EA	4	310	1240					$1,240.00
	TOTAL									$6,234.00
15	BUILDING 1530									
	APPURTENANCES	EA	16	LABOR AND MATERIALS 488	7808					$7,808.00
	1.0 KW	EA	8	270	2160					$2,160.00
	2.0 KW	EA	2	290	580					$580.00
	3.0 KW	EA	6	310	1860					$1,860.00
	TOTAL									$12,408.00

Material Source: Sierra Technical Products, Inc., Denver, CO; Prices include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR
EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C–200, DENVER, CO 80227

CONTRACT FOR (Work to be performed)
DOMESTIC HOT WATER HEATERS

PROPOSED TOTAL CONTRACT PRICE

PURCHASE REQUEST NUMBER

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
16	BUILDING 1558									
	APPURTENANCES	EA	7	LABOR AND MATERIALS 488	3416					$3,416.00
	1.0 KW	EA	2	270	540					$540.00
	3.0 KW	EA	1	310	310					$310.00
	10.0 KW	EA	4	850	3400					$3,400.00
	TOTAL									$7,666.00
17	BUILDING 1621									
	APPURTENANCES	EA	3	LABOR AND MATERIALS 488	1464					$1,464.00
	1.0 KW	EA	2	270	540					$540.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$2,314.00

Mater rce: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): DOMESTIC HOT WATER HEATERS

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
18	BUILDING 1622									
	APPURTENANCES	EA	16	LABOR AND MATERIALS 488	7808					$7,808.00
	1.0 KW	EA	9	270	2430					$2,430.00
	1.5 KW	EA	1	280	280					$280.00
	3.0 KW	EA	6	310	1860					$1,860.00
	TOTAL									$12,378.00
19	BUILDING 1624									
	APPURTENANCES	EA	14	LABOR AND MATERIALS 488	6832					$6,832.00
	1.0 KW	EA	6	270	1620					$1,620.00
	2.0 KW	EA	2	290	580					$580.00
	3.0 KW	EA	6	310	1860					$1,860.00
	TOTAL									$10,892.00

Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

DOMESTIC HOT WATER HEATERS

PROPOSED TOTAL CONTRACT PRICE

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
20	BUILDING 1751									
	APPURTENANCES	EA	3	LABOR AND MATERIALS 488	1464					$1,464.00
	1.0 KW	EA	1	270	270					$270.00
	1.5 KW	EA	1	280	280					$280.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$2,324.00
21	BUILDING 1753									
	APPURTENANCES	EA	3	LABOR AND MATERIALS 488	1464					$1,464.00
	1.0 KW	EA	2	270	540					$540.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$2,314.00
22	BUILDING 1790									
	APPURTENANCES	EA	3	LABOR AND MATERIALS 488	1464					$1,464.00
	1.5 KW	EA	2	280	560					$560.00
	3.0 KW	EA	1	310	310					$310.00
	TOTAL									$2,334.00

Mate[illegible]urce: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source[illegible]s Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

DOMESTIC HOT WATER HEATERS

PROPOSED TOTAL CONTRACT PRICE

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

				MATERIAL COST		LABOR COSTS				
	Item (1)	Unit of Measure (2)	Quantity (3)	Unit (4)	Total (5)	Manhours Mandays (6)	Average Rate (7)	Total (8)	Other Direct Costs (9)	Line Total (10)
23	BUILDING 1794									
	APPURTENANCES	EA	3	LABOR AND MATERIALS 488	1464					$1,464.00
	96 KW	EA	2	5300	10600					$10,600.00
	3 KW	EA	1	310	310					$310.00
	TOTAL									$12,374.00
24	BUILDING 464									
	APPURTENANCES	EA	6	LABOR AND MATERIALS 488	2928					$2,928.00
	1 KW	EA	5	270	1350					$1,350.00
	3 KW	EA	1	310	310					$310.00
	TOTAL									$4,588.00

Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

DOMESTIC HOT WATER HEATERS

PROPOSED TOTAL CONTRACT PRICE

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

			MATERIAL COST		LABOR COSTS				
Item (1)	Unit of Measure (2)	Quantity (3)	Unit (4)	Total (5)	Manhours Mandays (6)	Average Rate (7)	Total (8)	Other Direct Costs (9)	Line Total (10)
APPURTENANCES									
			LABOR AND MATERIALS						
1/2" GATE VALVES	EA	3	25	75					$75.00
COPPER PIPE	FT.	10	5	50					$50.00
WIRING	FT.	75	3.07	230.25					$230.25
CIRCUIT BREAKER	EA	1	65	65					$65.00
JUNCTION BOX	EA	1	10	10					$10.00
SWITCH BOX	EA	1	20	20					$20.00
ELEC. HEATER (LABOR ONLY)	EA						38		$38.00
TOTAL COST W/O HEATER PER INSTALLATION									$488.25

Mater[illegible]urce: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: [illegible]s Cost Data, 1992, Rates Include Overhead & Profit

INDEECO

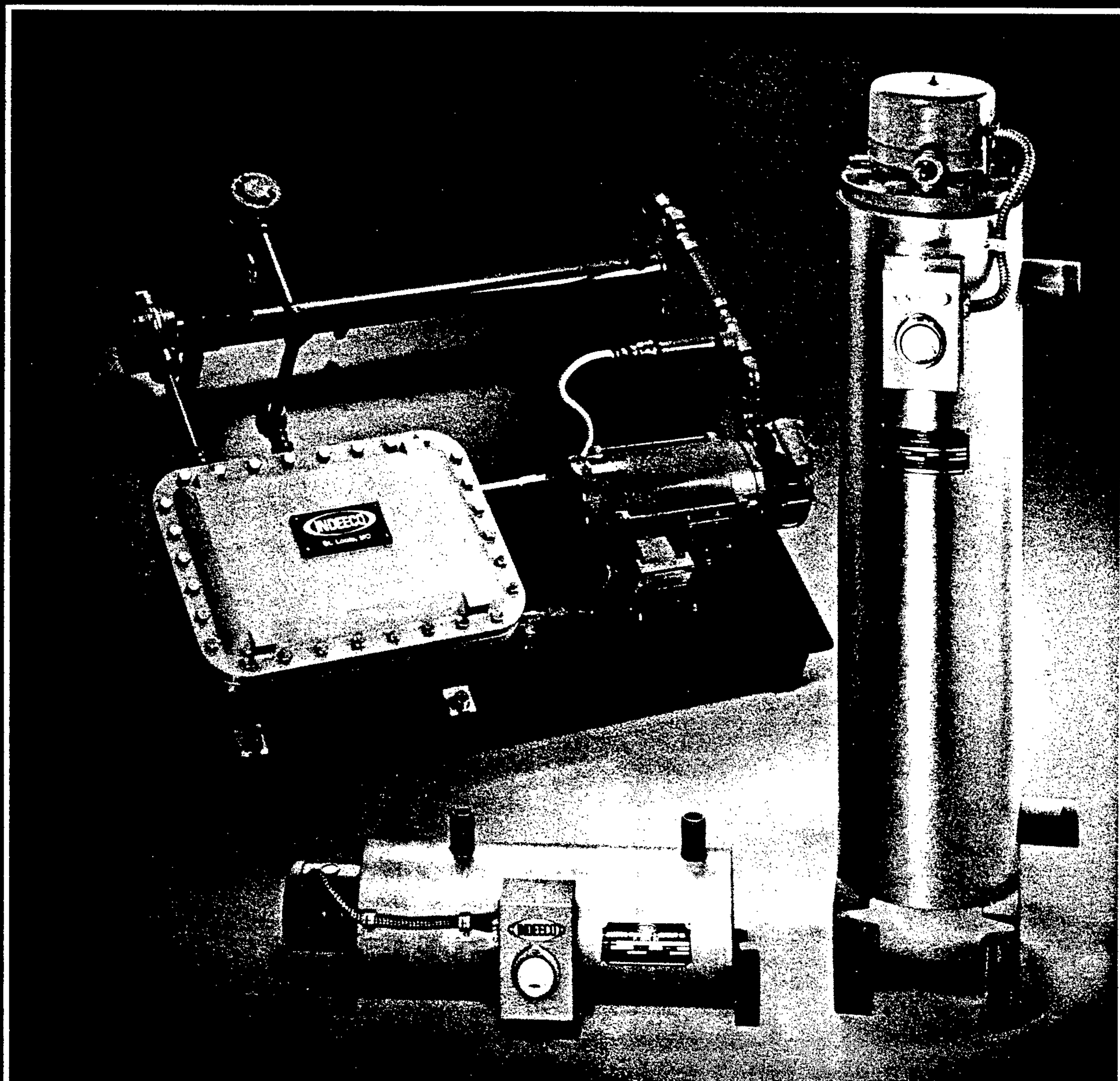
C35-2

Circulation Heaters

for Liquids and Gases

Featuring New
Multi-Purpose Design

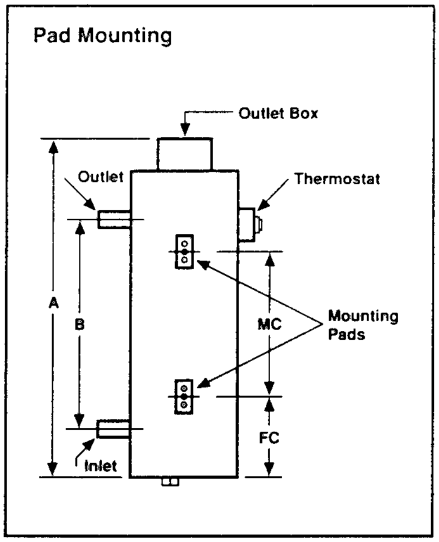
425 Hanley Industrial Court
St. Louis, Missouri 63144
(314) 644-4300
FAX (314) 644-5332

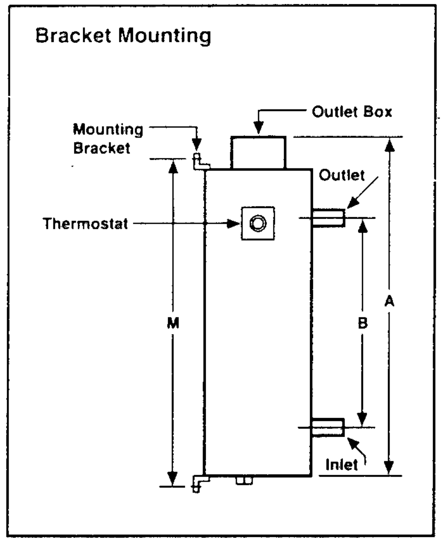


D4-33

The Series 355 (50 W/In²) INDEECO circulation heaters are designed for heating water. These high quality Water Heaters include the following standard features:

- *Copper Sheathed .475" Diameter Heating Elements*
- *Insulated Steel Vessel with a Galvanized Jacket*
- *NEMA 1 Terminal Enclosure*
- *Built-On Thermostat, 60°-250° F. Range*
- *Choice of Mounting Brackets or Mounting Pads - Six Options Available. See Page 15.*
- *Flange Heaters have 150 Lb Steel Flanges which meet ANSI B16.5 Standards.*
- *Rated 160 PSI at 250°F.*





Reference Dimensional Drawings on Page 14.

KW	NO. OF ELEMENTS	CATALOG NUMBER			DIMENSIONS (INCHES)					WEIGHT (LBS)
		240V/1 PHASE	240V/3 PHASE	480V/3 PHASE	A	B	MC	FC	M	
2½" PIPE THREAD CONSTRUCTION, COPPER ELEMENTS, 50 W/IN²										
3.0	3	3552N003J01*	3552N003K01*		21¼	9⅜	-	-	18½	30
4.5	3	3552N005J01*	3552N005K01*	3552N005U01	21¼	9⅜	—	—	18½	30
6.0	3	3552N006J01*	3552N006K01*	3552U006U01	34⅜	22½	16½	5⅝	31⅝	40
7.5	3	3552N008J01*	3552N008K01*	3552U008U01	34⅜	22½	16½	5⅝	31⅝	41
9.0	3	3552N009J01*	3552N009K01*	3552U009U01	34⅜	22½	16½	5⅝	31⅝	41
3" - 150 LB. FLANGE CONSTRUCTION, COPPER ELEMENTS, 50 W/IN²										
6	3	3553N006J01*	3553N006K01*	3553N006U01	34¼	22½	16½	4⅛	30¼	65
9	3	3553N009J01*	3553N009K01*	3553N009U01	34¼	22½	16½	4⅛	30¼	66
12	3	3553N012J03	3553N012K01*	3553N012U01	46¼	34½	26½	4⅛	42¼	81
15	3	3553N015J03	3553N015K01	3553N015U01	56¾	45	39	4⅛	52¾	91
18	3	3553N018J03	3553N018K01	3553N018U01	56¾	45	39	4⅛	52¾	93
5" - 150 LB. FLANGE CONSTRUCTION, COPPER ELEMENTS, 50 W/IN²										
24	6	3554N024J03	3554N024K02	3554N024U01	43½	30	25	4¾	38⅞	135
30	6		3554N030K02	3554N030U01	50½	37	25	9	45⅞	150
45	9		3554N045K03	3554N045U03	50½	37	25	9	45⅞	157
63	9			3554N063U03	62	48½	25	14	57⅜	181
8" - 150 LB. FLANGE CONSTRUCTION, COPPER ELEMENTS, 50 W/IN²										
72	18		3555N072K06	3555N072U02	53⅜	34½	31	8¾	47½	302
96	24		3555N096K08	3555N096U04	53⅜	34½	31	8¾	47½	312
126	18			3555N126U06	66⅛	47⅜	43 13/16	8¾	60¼	361
144	18			3555N144U06	75⅝	56⅞	53 5/16	8¾	69¾	396
180	18			3555N180U06	86⅜	67½	64	8¾	80½	443
240	24			3555N240U08	86⅜	67½	64	8¾	80½	466
12" - 150 LB. FLANGE CONSTRUCTION, COPPER ELEMENTS, 50 W/IN²										
250	42			3557N250U07	64	40	—	—	58 9/16	748
300	48			3557N300U08	74	50	—	—	68 9/16	819
350	48			3557N350U16	84	60	—	—	78 9/16	889
400	48			3557N400U16	84	60	—	—	78 9/16	906
450	48			3557N450U16	84	60	—	—	78 9/16	924
500	48			3557N500U16	94	70	—	—	88 9/16	942
16" - 150 LB. FLANGE CONSTRUCTION, COPPER ELEMENTS, 50 W/IN²										
500	72			3558N500U24	73½	48	—	—	67⅞	1110
600	72			3558N600U24	83½	58	—	—	77⅞	1210
700	72			3558N700U24	93½	68	—	—	87⅞	1284
800	72			3558N800U24	101½	76	—	—	95⅞	1399

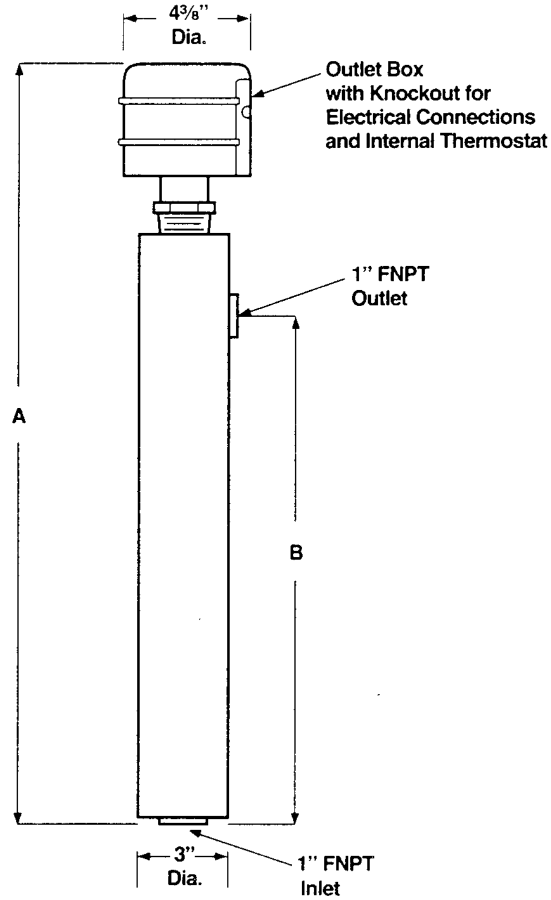
Indicates factory wired, built-on load carrying thermostat.

All other built-on thermostats are pilot duty only.

Last two digits of catalog number indicate number of Heater Circuits.

STOCK HEATER LISTING

KW	CATALOG NUMBER 120V/1 PHASE OR 240V/1 PHASE	DIMENSIONS (INCHES)		WEIGHT (LBS)
		A	B	
1.5	3591S01.5X01	19⅞	12⅜	10
2.0	3591S02.0X01	19⅞	12⅜	10
2.5	3591S02.5X01	23⅞	16⅜	12
3.0	3591S03.0X01	23⅞	16⅜	12



These compact, lightweight, easy to install heaters can be used for many commercial or light industrial water heating applications. The high quality MINI-BOOSTER Water Heater includes the following standard features:

- *1-1/4" Pipe Thread Immersion Heater with integral load carrying 60° to 180°F thermostat.*
- *Insulated galvanized steel pipe vessel with painted steel jacket.*
- *Two .312" diameter copper elements rated at 80 W/In².*
- *NEMA 1 terminal enclosure*
- *No mounting brackets required.*
- *Dual voltage design allows for operation with 120V or 240V power supply.*

HEAT LOSS MODEL FOR ECO #10: INSTANTANEOUS, POINT-OF-USE ELECTRIC HW ~~HEATRS~~.

$$\text{ENERGY SAVINGS}\left(\frac{BTU}{YR}\right) = \left(\begin{array}{c}\text{ENERGY CONSUMPTION}\\ \text{OF EXISTING SYSTEM}\end{array}\right) - \left(\begin{array}{c}\text{ENERGY CONSUMPTION}\\ \text{OF PROPOSED SYSTEM}\end{array}\right)$$

ENERGY CONSUMPTION OF EXISTING SYSTEM

$$\dot{q}\left(\frac{BTU}{YR}\right) = \text{USAGE} + \underset{\text{DURING OCCUPANCY}}{\text{PIPING LOSSES}} + \underset{\text{AFTER OCCUPANCY}}{\text{PIPING LOSSES}} + \underset{\text{LOSSES}}{\text{STORAGE}}$$

$$\dot{q} = \begin{cases} \dot{q}_1\big|_{USAGE} + \dot{q}_2\big|_{\substack{piping\\ LOSS}} + \dot{q}_3\big|_{\substack{STORAGE\\ LOSS}} + \dot{q}_4\big|_{\substack{ULLAGE\\ LOSS}} & \text{if no circulation pump} \\ \dot{q}_1\big|_{USAGE} + \dot{q}_3\big|_{STORAGE} + \dot{q}_5\big|_{pipes} & \text{If a circulation pump runs constantly.} \end{cases}$$

Summary of Equations:

① $\dot{q}_1\big|_{USAGE} = 154{,}142 \times \#\,\text{OCCUPANTS} \quad (BTU/YR)$

② $\dot{q}_2\big|_{piping} = 2083 \times \#\,\text{OCCUPANTS} \times (T_{STORAGE} - T_{SINK})\left(\frac{BTU}{yr}\right)$

③ $\dot{q}_3\big|_{STORAGE} = 8760 \times \left[UA\big|_{\substack{TANK\\ ENDS}} + \dfrac{2\pi L}{\frac{1}{k}\ln(D_o/D_i) + \frac{2}{h_o D_o}} \right](T_{STOR} - T_{RM})$

④ $\dot{q}_4\big|_{\substack{PIPE\\ ULLAGE}} = 2083\,Q \times \left(\dfrac{T_{STOR} + T_{SINK}}{2} - 70\right) \quad BTU/YR$

⑤ $\dot{q}_5\big|_{\substack{PIPE\\ w/circ\ pump}} = 8760 \times \sum_{j} \left[\left[\dfrac{BTU\ LOSS}{hr\text{-}Ft}\right]_i \times L_j(ft)\right]$ $\quad j \equiv$ pipe diameter index

See following derivations for definitions of symbols.

(1) Consumed HW: Per ASHRAE, daily hot water consumption at 140°F is 1.0 gal/person.

work days/year = 5 days/wk × 50 wks/yr = 250.

$$\dot{q}_1\Big|_{usage} = \dot{m}\left(\frac{LB}{yr}\right) \times C_p\left(\frac{BTU}{LB-°F}\right) \times (T.R)\,(°F)$$

where $\dot{m} = 8.33\,\frac{LB}{gal} \times 1.0\,\frac{gal}{day-person} \times N\,(people) \times 250\,\frac{days}{yr}$

$$\dot{m}\left(\frac{LB}{yr}\right) = 2083 \times N \text{ (no. of occupants)}$$

$$C_p = 1.0\ \frac{BTU}{LB-°F}$$

$$TR = \text{Temp. rise} = \cancel{140} - 66 = 74$$

$$\dot{q}\Big|_{usage}\left(\frac{BTU}{yr}\right) = 2083 \times N \times 74 = 154{,}142 \times N$$

(2) Piping heat Loss from storage tank to sink.

$$\dot{q}_2\Big|_{\substack{pipe\\loss}}\left(\frac{BTU}{yr}\right) = \dot{m}\, C_p\, \Delta T$$

$$= 2083\, N \times (T_{STOR} - T_{sink})$$

N = # occupants

(3) CYLINDRICAL TANK ~~HEAT~~ LOSS

For the cylinder portion of the tank.

$$\dot{q}\left(\frac{BTU}{yr}\right) = \frac{2\pi L (T_{storage} - T_{room}) \times 8760}{\left(\frac{1}{K} \ln (D_o/D_i) + (2/h_o D_o)\right)}$$

where $D_o(ft)$ = outer diameter of insulated tank
$D_i(ft)$ = outer diameter of steel tank
$L(ft)$ = length of tank
$K = 0.021 \frac{BTU-ft}{hr-ft^2-°F}$
$h_o = 0.19(T_{STOR} - T_{rm})^{0.33} \frac{BTU}{hr-ft^2-°F}$ *

h_o	0.69	0.73	0.77	0.81	0.84
T_{STOR}	120	130	140	150	160
T_{rm}	70	70	70	70	70

*(See ASHRAE 1989 Fundamentals, Table 5, pg 3.12)

For the ends,

$$\dot{q}\left(\frac{BTU}{yr}\right) = U A (T_{STOR} - T_{rm}) \times 8760$$

$U = \frac{1}{R_{ins} + R_{air}}$ $R_{ins} = 7.5 \frac{°F-hr-ft^2}{BTU}$
$R_{air} = 0.68$ "

$U = \frac{1}{7.5 + .68} = 0.122 \frac{BTU}{hr-ft^2-°F}$

$A_{end} = \frac{\pi}{4} D_i^2$

LARGE TANKS WITH 2" FIBERGLASS INSULATION (HORIZONTAL)

$L \simeq 2Di$

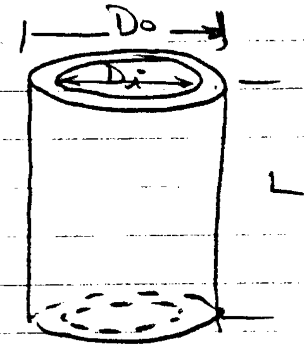
$Do = Di + 0.333$

$Volume = A_{end} \times L = \frac{\pi Di^2}{4} \times 2Di \times 7.48 = 11.75\, Di^3$

$Di \simeq \sqrt[3]{\frac{VOL}{11.75}}$

Volume (gal)	200	300	500	750	1000
Di (ft)	2.57	2.94	3.49	4.00	4.40
Do (ft)	2.90	3.27	3.82	4.33	4.73
L (ft)	5.14	5.88	6.98	8.00	8.80
A_{end} (ft^2)	5.19	6.79	9.57	12.57	15.20
U_{end} ($\frac{BTU}{Hr\text{-}FT^2\text{-}°F}$)	0.122	0.122	0.122	0.122	0.122
T_{STOR} (°F)	130	130	130	130	130
T_{Room} (°F)	70	70	70	70	70
$\mathring{q}_{end}$ (BTU/yr)	$.33 \times 10^6$	$.435 \times 10^6$	$.614 \times 10^6$	$.806 \times 10^6$	$.975 \times 10^6$
$2/h_o Do$	0.945	0.838	0.717	0.633	0.579
$\frac{1}{K} \ln\left(\frac{Do}{Di}\right)$	5.75	5.07	4.30	3.77	3.44
$2\pi L(\Delta T) \times 8760$	16.97×10^6	19.42×10^6	23.05×10^6	26.42×10^6	29.06×10^6
$\mathring{q}_{CYL.}$ ($\frac{BTU}{yr}$)	2.53×10^6	3.29×10^6	4.59×10^6	6.00×10^6	7.23×10^6
$\mathring{q}_3 \Big\vert_{\text{STORAGE (LARGE TANKS)}}$ ($\frac{BTU}{YR}$)	3.19×10^6	4.16×10^6	5.82×10^6	7.61×10^6	9.18×10^6

SMALL TANK (VERTICAL) HEAT LOSS



Insulation thickness = 1" = $\frac{1}{12}$ FT.

$D_o = D_i + \frac{2}{12} = D_i + .083$

$L \simeq 2.75\, D_i$ (from several manufacturers' catalogs)

$\text{Volume (gal)} = 7.48 \times \frac{\pi D_i^2}{4} \times 2.75 D_i$

$D_i = \sqrt[3]{\frac{Vol}{16.16}}$

$\text{Area of top} = A_{TOP} = \frac{\pi D_i^2}{4}$

$\dot{q}_{TOP} = U_{TOP} \times A_{TOP} \times \Delta T \times 8760 \qquad \Delta T = T_{STORAGE} - T_{ROOM} = T_{STOR} - 70°$

$U_{TOP} = \frac{1}{R_{ins} + h_o} = \frac{1}{3.14 + .61} = 0.267$

$\dot{q}_{TOP} = \frac{0.267 \times \pi \times 8760\, D_i^2 (T_{STOR} - 70)}{4} = 1837 \times D_i^2 (T_{STOR} - 70)\ \frac{BTU}{yr.}$

$\dot{q}_{BOTTOM} = U_{BOTTOM} \times A \times \Delta T \times 8760 \;;\; U_{BOTTOM} = \frac{1}{R_{STEEL} + .92} = \frac{1}{.92} = 1.09$

$= 1.09\, \frac{\pi D_i^2}{4} \times 8760 \times (T_{STOR} - 70)$

$= 7499\, D_i^2 (T_{STOR} - 70)\ BTU/yr.$

$\dot{q}_{CYL} = \frac{2\pi L \Delta T \times 8760}{\frac{1}{K}\ln\left(\frac{D_o}{D_i}\right) + \frac{2}{h_o D_o}}\ , \quad K = 0.021 \;;\; h_o = 0.77 \;;\; L = 2.75 D_i$

see table on p. 3

$= \frac{151{,}362\, D_i (\Delta T)}{47.6 \ln\left(\frac{D_o}{D_i}\right) + \frac{2}{0.77 \times D_o}}\ BTU/yr \;;\; D_o = D_i + 0.083$

$\Delta T = T_{STOR} - 70$

$\dot{q}_{STOR} = \dot{q}_{TOP} + \dot{q}_{BOTTOM} + \dot{q}_{CYL.}$

Vol (GAL)	40	50	60	80	85	97	100	120
Di (FT)	1.353	1.457	1.548	1.704	1.739	1.817	1.836	1.950
Do (FT)	1.436	1.540	1.631	1.787	1.822	1.900	1.919	2.033
Do/Di	1.061	1.057	1.054	1.049	1.048	1.046	1.045	1.043
T_{STOR} (°F)	135	124	136	122	127	130	150	125
$\dot{q}_{TOP}$ $\left(\frac{MBTU}{YR}\right)$	.219	.211	.291	.277	.317	.364	.372	.384
$\dot{q}_{BOTTOM}$ $\left(\frac{MBTU}{YR}\right)$	.894	.861	1.188	1.131	1.294	1.486	1.519	1.568
$\dot{q}_{CYL}$ $\left(\frac{MBTU}{YR}\right)$	3.573	3.398	4.634	4.384	4.993	5.709	7.830	5.971
$\dot{q}_{STOR}$ (MBTU/YR)	4.686	4.470	6.113	5.792	6.604	7.559	9.721	7.923

④ PIPING ULLAGE HEAT LOSS AFTER BUILDINGS CLOSE

$$\dot{q}_4 \left(\frac{BTU}{YR}\right)\Big|_{ULLAGE} = \overset{Q}{\cancel{\text{Volume}}}\,(GAL) \times 8.33 \times \frac{1.0\,BTU}{LB\ {}^\circ F} \times (T_{pipe} - \overset{70}{\cancel{T_{room}}}) \times M$$
$$= 2083\,Q \times (T_{pipe} - 70) \times M$$

M = # of cool down cycles/yr (normally 250)

Q = volume of system (ullage) in gallons.

$$T_{pipe} = \frac{T_{STORAGE} + T_{SINK}}{2}$$

Volume (GAL) = GAL/FT × length of pipe

FROM MECH ENG HANDBOOK

NOM. pipe size (in)	GAL/FT
½	.0150
3/4	.0277
1	.0449
1¼	.0777
2	.1743
2½	.2490

(5) HEAT LOSS FROM DHW PIPES WITH CONSTANT CIRCULATION

$$\dot{q}_5\left(\frac{BTU}{YR}\right) = 8760\,\frac{HR}{YR} \times \sum_i \left[\left.\frac{BTU\ loss}{hr\text{-}ft}\right|_i \times L_i(ft)\right]$$

where i = pipe size index

$\frac{BTU\ loss}{hr\text{-}ft_i}$ = heat loss rate per foot of pipe of size "i". See ASHRAE 1991 Applications HB, p 44.4.

Table 2 Heat Loss of Pipe
(at 140 °F Inlet, 70 °F Ambient Temperatures)

Pipe Size, in.	Bare Copper Tubing, Btu/h · ft	0.5-in. Glass Fiber Insulated Copper Tubing, Btu/h · ft
0.75	30	17.7
1	38	20.3
1.25	46	23.4
1.5	53	25.4
2	66	29.6
2.5	80	33.8
3	94	39.5
4	120	48.4

Take Li from drawings or estimate them.

ENERGY CONSUMPTION OF INSTANTANEOUS POINT-OF-USE

ELECTRIC HW HEATER

HEAT LOAD = USAGE = $\dot{m}\, c_p\, \Delta T$ = 154,142 × # OCCUPANTS BTU/yr.

ELEC ENERGY USED = $\dfrac{\text{HEAT LOAD}}{\text{AFUE}} = \dfrac{\text{HEAT LOAD}}{1.0}$

= 154,142 × # OCCUPANTS (BTU/YR)

Table 1 Dimensionless Numbers Commonly Used in Heat Transfer[a]

Name	Symbol	Value	Application
Nusselt Number	Nu	hD/k or hL/k	Natural or Forced Convection, Boiling or Condensing
Reynolds Number	Re	GD/μ or $\varrho VL/\mu$	Forced Convection
Prandtl Number	Pr	$\mu c_p/k$	Natural or Forced Convection, Boiling or Condensing
Stanton Number	St	h/Gc_p	Forced Convection
Grashof Number	Gr	$L^3\varrho^2\beta g(\Delta t)/\mu^2$ or $L^3\varrho^2 g(\Delta t)/T\mu^2$	Natural Convection (for ideal gases)
Fourier Number	Fo	$\alpha\tau/L^2$	Unsteady State Conduction
Peclet Number	Pe	GDc_p/k or $Re\ Pr$	Forced Convection (small Pr)
Graetz Number	Gz	GD^2c_p/kL or Re Pr D/L	Laminar Convection

[a] A complete list of nomenclature appears at the end of this chapter.

forced convection. If the fluid flow is generated internally by nonhomogeneous densities caused by temperature variation, the heat transfer is termed *free* or *natural convection.*

In conduction and convection, heat transfer takes place through matter. For *radiant heat transfer,* there is a change in energy form; from internal energy at the source to electromagnetic energy for transmission, then back to internal energy at the receiver. Whereas conduction and convection are affected primarily by temperature difference and somewhat by temperature level, the heat transferred by radiation increases rapidly as the temperature increases.

Although some generalized heat transfer equations have been mathematically derived from fundamentals, usually they are obtained from correlations of experimental data. Normally, the correlations employ certain dimensionless numbers from analyses such as dimensional analysis or analogy. Table 1 lists some important dimensionless numbers.

STEADY STATE CONDUCTION

For steady state heat conduction in one dimension, the Fourier equation applies:

$$q = -kA(dt/dx) \qquad (1)$$

where

q = heat flow rate, Btu/h
k = thermal conductivity, Btu/h·ft·°F
A = cross-sectional area normal to flow, ft²
dt/dx = temperature gradient, °F/ft

Equation (1) states that the heat flow rate q in the x direction is directly proportional to the temperature gradient dt/dx and the cross-sectional area A normal to the flow. The proportionality factor is the thermal conductivity, k. The minus sign indicates that the heat flow is positive in the direction of decreasing temperature. Since conductivity values are sometimes given in other units, consistent units must be used.

Equation (1) may be integrated along a path of constant heat flow rate to obtain:

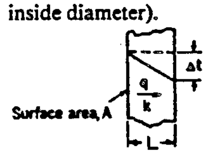
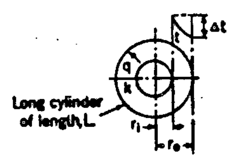
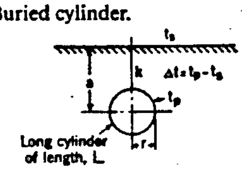
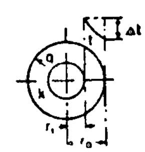
$$q = k(A_m/L_m)\Delta t = \Delta t/R \qquad (2)$$

where

A_m = mean cross-sectional area normal to flow, ft²
L_m = mean length of heat flow path, ft
Δt = overall temperature difference, °F
R = thermal resistance, °F·h/Btu

The *thermal resistance, R,* is directly proportional to the mean length of the heat flow path, L_m, and inversely proportional to the conductivity, k, and the mean cross-sectional area normal to the flow, A_m. Equations for thermal resistances of a few common shapes are given in Table 2. Mathematical solutions to many heat conduction problems are addressed by Carslaw and Jaeger (1959). Complicated problems can be solved by graphical or numerical methods such as described by Croft and Lilley (1977), Adams and Rogers (1973), and Patankar (1980).

Table 2 Solutions for Some Steady State Thermal Conduction Problems

System	R in Equation $q = \Delta t/R$
Flat wall or curved wall if curvature is small (wall thickness less than 0.1 of inside diameter). 	$R = \dfrac{L}{kA}$
Radial flow through a right circular cylinder. 	$R = \dfrac{\ln(r_o/r_i)}{2\pi kL}$
Buried cylinder. 	$R = \dfrac{\ln[(a + \sqrt{a^2 - r^2})/r]}{2\pi kL} = \dfrac{\cosh^{-1}(a/r)}{2\pi kL}\ (L>>2r)$
Radial flow in a hollow sphere. 	$R = \dfrac{(1/r_i - 1/r_o)}{4\pi k}$

L, r, a = dimensions, ft
k = thermal conductivity (at average material temperature, Btu/h·ft·°F
h = heat transfer coefficient, Btu/h·ft²·°F
A = surface area, ft²

in Table 9A between 180°F and 280°F, heat loss from a 2-in. pipe is 285.3 Btu/h·ft. Total annual heat loss from the entire line is 285.3 Btu/h·ft × 165 ft × 4000 h = 188 million Btu.

In calculating heat flow, Equations (9) and (10) from Chapter 20 generally are used. For dimensions of standard pipe and fitting sizes refer to the Piping Handbook. For insulation product dimensions refer to ASTM *Standard* C 585, "Recommended Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS) System," or to the insulation manufacturers' literature.

Examples 8 and 9 illustrate how Equations (9) and (10) from Chapter 20 can be used to determine heat loss from both flat and cylindrical surfaces. Figure 6 shows surface resistance as a function of heat transmission for both flat and cylindrical surfaces. The surface emittance is assumed to be 0.85 to 0.90 in still air at 80°F.

Example 8. Compute heat loss from a boiler wall if the interior insulation surface temperature is 1100°F and ambient still air temperature is 80°F. The wall is insulated with 4.5 in. of mineral fiber block and 0.5 in. of mineral fiber insulating and finishing cement.

Solution: Assume that the mean temperature of the mineral fiber block is 700°F, the mean temperature of the insulating cement is 200°F and the surface resistance, R_s, is 0.60.

From Table 8, $k_1 = 0.62$ and $k_2 = 0.80$. Using Equation (9) from Chapter 20:

$$q_s = \frac{1100 - 80}{(4.5/0.62) + (0.5/0.80) + 0.60} = \frac{1020}{8.48}$$
$$= 120.2 \text{ Btu/h}\cdot\text{ft}^2$$

As a check, from Figure 6, at 120.2 Btu/h·ft², $R_s = 0.56$. The mean temperature of the mineral fiber block is:

$$4.5/0.62 = 7.26;\ 7.26/2 = 3.63$$
$$1100 - [(3.63/8.48)(1020)] = 1100 - 437 = 663\,°\text{F}$$

and the mean temperature of the insulating cement is:

$$0.5/0.80 = 0.63;\ 0.63/2 = 0.31;\ 7.26 + 0.31 = 7.57$$
$$1100 - [(7.57/8.48)(1020)] = 1100 - 911 = 189\,°\text{F}$$

From Table 8, at 663°F, $k_1 = 0.60$; at 189°F, $k_2 = 0.79$. Using these adjusted values to recalculate q_s:

$$q_s = \frac{1020}{(4.5/0.60) + (0.5/0.79) + 0.56} = \frac{1020}{8.69}$$
$$= 117.4 \text{ Btu/h}\cdot\text{ft}^2$$

Table 8 Typical Thermal Conductivity (k) for Industrial Insulations at Various Mean Temperatures – Design Values[a]

Material	Accepted Max. Temp. for Use[b], °F	Typical Density, lb/ft³	Typical Conductivity k in Btu·in/h·ft²·°F at Mean Temp, °F													
			−100	−75	−50	−25	0	25	50	75	100	200	300	500	700	900
BLANKETS AND FELTS																
ALUMINOSILICATE FIBER																
7-10μ diameter fiber	1800	4								0.24		0.32		0.54	0.99	1.03
	2000	6-8								0.25		0.30		0.48	0.78	0.95
3μ diameter fiber	2200	4								0.22		0.29		0.45	0.59	0.74
MINERAL FIBER (Rock, slag or glass)																
Blanket, metal reinforced	1200	6–12									0.26	0.32	0.39	0.54		
	1000	2.5-6									0.24	0.31	0.40	0.61		
Blanket, flexible, fine-fiber organic bonded	350	<0.75				0.25	0.26	0.28	0.30	0.33	0.36	0.53				
		0.75				0.24	0.25	0.27	0.29	0.32	0.34	0.48				
		1.0				0.23	0.24	0.25	0.27	0.29	0.32	0.43				
		1.5				0.21	0.22	0.23	0.25	0.27	0.28	0.37				
		2.0				0.20	0.21	0.22	0.23	0.25	0.26	0.33				
		3.0				0.19	0.20	0.21	0.22	0.23	0.24	0.31				
Blanket, flexible, textile-fiber organic bonded	350	0.65				0.27	0.28	0.29	0.30	0.31	0.32	0.50	0.68			
		0.75				0.26	0.27	0.28	0.29	0.31	0.32	0.48	0.66			
		1.0				0.24	0.25	0.26	0.27	0.29	0.31	0.45	0.60			
		1.5				0.22	0.23	0.24	0.25	0.27	0.29	0.39	0.51			
		3.0				0.20	0.21	0.22	0.23	0.24	0.25	0.32	0.41			
Felt, semirigid organic bonded	400	3–8						0.24	0.25	0.26	0.27	0.35	0.44			
	850	3	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.35	0.55			
Laminated and felted without binder	1200	7.5											0.35	0.45	0.60	
BLOCKS, BOARDS, AND PIPE INSULATION																
MAGNESIA	600	11–12									0.35	0.38	0.42			
85% CALCIUM SILICATE	1200	11–15									0.38	0.41	0.44	0.52	0.62	0.72
	1800	12–15												0.63	0.74	0.95
CELLULAR GLASS	900	8.5	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.35	0.36	0.42	0.49	0.70	1.03	
DIATOMACEOUS SILICA	1600	21–22												0.64	0.68	0.72
	1900	23–25												0.70	0.75	0.80
MINERAL FIBER																
Glass,																
Organic bonded, block and boards	400	3–10	0.16	0.17	0.18	0.19	0.20	0.22	0.24	0.25	0.26	0.33	0.40			
Nonpunking binder	1000	3–10									0.26	0.31	0.38	0.52		
Pipe insulation, slag, or glass	350	3–4					0.20	0.21	0.22	0.23	0.24	0.29				
	500	3–10					0.20	0.22	0.24	0.25	0.26	0.33	0.40			
Inorganic bonded block	1000	10–15									0.33	0.38	0.45	0.55		
	1800	15–24									0.32	0.37	0.42	0.52	0.62	0.74
Pipe insulation, slag, or glass	1000	10–15									0.33	0.38	0.45	0.55		
Resin binder		15	0.23	0.24	0.25	0.26	0.28	0.29								

Table 8 Typical Thermal Conductivity (*k*) for Industrial Insulations at Various Mean Temperatures – Design Values[a] (*Concluded*)

Material	Accepted Max. Temp. for Use[b], °F	Typical Density, lb/ft³	Typical Conductivity k in Btu·in/h·ft²·°F at Mean Temp., °F: −100	−75	−50	−25	0	25	50	75	100	200	300	500	700	900
RIGID POLYSTYRENE																
Extruded (CFC-12 exp.) (smooth skin surface)	165	1.8–3.5	0.16	0.16	0.17	0.16	0.17	0.18	0.19	0.20						
Molded beads	165	1	0.17	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.28					
		1.25	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.25	0.27					
		1.5	0.16	0.17	0.19	0.20	0.21	0.22	0.23	0.24	0.26					
		1.75	0.16	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.25					
		2.0	0.15	0.16	0.18	0.19	0.20	0.21	0.22	0.23	0.24					
RIGID POLYURETHANE/ POLYISOCYANURATE[c,d] Unfaced (CFC-11 exp.)	210	1.5–2.5	0.16	0.17	0.18	0.18	0.18	0.17	0.16	0.16	0.17					
RIGID POLYISOCYANURATE[e] Gas-impermeable facers (CFC-11 exp.)	250	2.0						0.12	0.13	0.14	0.15					
RIGID PHENOLIC Closed cell (CFC-11, CFC-113 exp.)		3.0						0.11	0.115	0.12	0.125					
RUBBER, Rigid Foamed	150	4.5						0.20	0.21	0.22	0.23					
VEGETABLE AND ANIMAL FIBER Wool felt (pipe insulation)	180	20						0.28	0.30	0.31	0.33					
INSULATING CEMENTS																
MINERAL FIBER (Rock, slag, or glass) With colloidal clay binder	1800	24–30									0.49	0.55	0.61	0.73	0.85	
With hydraulic setting binder	1200	30–40									0.75	0.80	0.85	0.95		
LOOSE FILL																
Cellulose insulation (milled pulverized paper or wood pulp)		2.5–3							0.26	0.27	0.29					
Mineral fiber, slag, rock, or glass		2–5			0.19	0.21	0.23	0.25	0.26	0.28	0.31					
Perlite (expanded)		3–5	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.35					
Silica aerogel		7.6			0.13	0.14	0.15	0.15	0.16	0.17	0.18					
Vermiculite (expanded)		7–8.2			0.39	0.40	0.42	0.44	0.45	0.47	0.49					
		4–6			0.34	0.35	0.38	0.40	0.42	0.44	0.46					

[a]Representative values for dry materials, which are intended as design (not specification) values for materials in normal use. Insulation materials in actual service may have thermal values that vary from design values depending on their in-situ properties (*e.g.*, density and moisture content). For properties of a particular product, use the value supplied by the manufacturer or by unbiased tests.

[b]These temperatures are generally accepted as maximum. When operating temperature approaches these limits follow the manufacturer's recommendations.

[c]Some polyurethane foams are formed by means that produce a stable product (with respect to k), but most are blown with refrigerant and will change with time.

[d]See Table 4, footnote h.

[e]See Table 4, footnote i.

From Figure 6, at 117.4 Btu/h·ft², $R_s = 0.56$. The mean temperature of the mineral fiber block is:

$$4.5/0.6 = 7.50;\ 7.50/2 = 3.75$$
$$1100 - [(3.75/8.69)(1020)] = 1100 - 440 = 660\,°F$$

and the mean temperature of the insulating cement is:

$$0.5/0.79 = 0.63;\ 0.63/2 = 0.31;\ 7.50 + 0.31 = 7.81$$
$$1100 - [(7.81/8.69)(1020)] = 1100 - 917 = 183\,°F$$

From Table 8, at 660°F, $k_1 = 0.60$; at 183°F, $k_2 = 0.79$.

Since R_s, k_1 and k_2 do not change at these values, $q_s = 117.4$ Btu/h·ft².

Example 9. Compute heat loss per square foot of outer surface of insulation if pipe temperature is 1200°F and ambient still air temperature is 80°F. The pipe is nominal 6-in. steel pipe, insulated with a nominal 3-in. thick diatomaceous silica as the inner layer and a nominal 2-in. thick calcium silicate as the outer layer.

Solution: From Chapter 33 of the 1988 EQUIPMENT Volume, $r_o = 3.31$ in. A nominal 3-in. thick diatomaceous silica insulation to fit a nominal 6-in. steel pipe is 3.02 in. thick. A nominal 2-in. thick calcium silicate insulation to fit over the 3.02-in. diatomaceous silica is 2.08 in. thick. Therefore, $r_i = 6.33$ in. and $r_s = 8.41$ in.

Assume that the mean temperature of the diatomaceous silica is 600°F, the mean temperature of the calcium silicate is 250°F and the surface resistance, R_s is 0.50. From Table 8, $k_1 = 0.66$; $k_2 = 0.42$. By Equation (10) from Chapter 20:

$$q_s = \frac{1200 - 80}{[8.41 \ln(6.33/3.31)/0.66] + [8.41 \ln(8.41/6.33)/0.40] + 0.50}$$

$$= \frac{1120}{(5.45/0.66) + (2.39/0.40) + 0.50} = 76.0\ \text{Btu/h·ft}^2$$

From Figure 6, at 76.0 Btu/h·ft², $R_s = 0.60$. The mean temperature of the diatomaceous silica is:

$$5.45/0.66 = 8.26;\ 8.26/2 = 4.13$$
$$1200 - [(4.13/14.83)(1120)] = 1200 - 312 = 888\,°F$$

and the mean temperature of the calcium silicate is:

$$2.39/0.40 = 5.98;\ 5.98/2 = 2.99;\ 8.26 + 2.99 = 11.25$$
$$1200 - [(11.25/14.83)(1120)] = 1200 - 850 = 350\,°F$$

From Table 8, $k_1 = 0.72$; $k_2 = 0.46$. Recalculating:

$$q_s = \frac{1120}{(5.45/0.72) + (2.39/0.46) + 0.60} = 83.8\ \text{Btu/h·ft}^2$$

From Figure 6 at 83.8 Btu/h·ft², $R_s = 0.59$. The mean temperature of the diatomaceous silica is:

$$5.45/0.72 = 7.57;\ 7.57/2 = 3.78$$
$$1200 - [(3.78/13.36)(1120)] = 1200 = 317 = 883\,°F$$

and the mean temperature of the calcium silicate is:

$$2.39/0.46 = 5.20;\ 5.20/2 = 2.60;\ 7.57 + 2.60 = 10.17$$
$$1200 - [(10.17/13.36)(1120)] = 1200 - 853 = 347\,°F$$

From Table 8, $k_1 = 0.72$; $k_2 = 0.46$. Recalculating:

$$q_s = \frac{1120}{(5.45/0.72) + (2.39/0.46) + 0.59} = 83.8\ \text{Btu/h·ft}^2$$

Since R_s, k_1, and k_2 do not change at 83.8 Btu/h·ft², this is q_s.

The heat flow per ft² of the inner surface of the insulation is:

$$q_o = q_s(r_s/r_o) = 83.8(8.41/3.31) = 213\ \text{Btu/h·ft}^2$$

laboratory test conditions. Air gaps in these types of insulation systems can seriously degrade thermal performance as a result of air movement due to both natural and forced convection. Sabine *et al.* (1975) found the tabular values are not necessarily additive for multiple-layer, low-emittance airspaces, and tests on actual constructions should be conducted to accurately determine thermal resistance values.

Values for foil insulation products supplied by manufacturers must also be used with caution because they apply only to systems that are identical to the configuration in which the product was tested. In addition, surface oxidation, dust accumulation, and other factors that change the condition of the low-emittance surface can reduce the thermal effectiveness of these insulation systems. Deterioration results from contact with several types of solutions, either acidic or basic (*e.g.*, wet cement mortar or the preservatives found in decay-resistant lumber). Polluted environments may cause rapid and severe material degradation. However, site inspections show a predominance of well-preserved installations and only a small number of cases in which rapid and severe deterioration has occurred.

CALCULATING OVERALL THERMAL RESISTANCES

Relatively small conductive elements within an insulating layer or thermal bridges can substantially reduce the average thermal resistance of a component. Examples include wood and metal studs in frame walls, concrete webs in concrete masonry walls, and metal ties or other elements in insulated wall panels. The following examples illustrate how to calculate R-values and U-factors for components containing thermal bridges.

The following conditions are assumed in calculating the design R-values:

(1) Equilibrium or steady-state heat transfer, disregarding effects of heat storage;

(2) Surrounding surfaces at ambient air temperature;

(3) Exterior wind velocity of 15 mph for winter (surface with R = 0.17 °F·ft²·h/Btu) and 7.5 mph for summer (surface with R = 0.25 °F·ft²·h/Btu); and

(4) Surface emittance of ordinary building materials is 0.90.

Table 1 Surface Conductances, Btu/h·ft²·°F, and Resistances, °F·ft²·h/Btu, for Air[a,b,c,d]

Position of Surface	Direction of Heat Flow	Surface Emittance, ε[e]: Non-reflective ε = 0.90		Reflective ε = 0.20		Reflective ε = 0.05	
		h_i	R	h_i	R	h_i	R
STILL AIR							
Horizontal	Upward	1.63	0.61	0.91	1.10	0.76	1.32
Sloping—45°	Upward	1.60	0.62	0.88	1.14	0.73	1.37
Vertical	Horizontal	1.46	0.68	0.74	1.35	0.59	1.70
Sloping—45°	Downward	1.32	0.76	0.60	1.67	0.45	2.22
Horizontal	Downward	1.08	0.92	0.37	2.70	0.22	4.55
MOVING AIR	(Any Position)	h_o	R	h_o	R	h_o	R
15-mph Wind (for winter)	Any	6.00	0.17	—		—	
7.5-mph Wind (for summer)	Any	4.00	0.25	—		—	

[a]No surface has both an airspace resistance value and a surface resistance value. No airspace value exists for any surface facing an airspace of less than 0.5 in.

[b]For ventilated attics or spaces above ceilings under summer conditions (heat flow down), see Table 5.

[c]Conductances are for surfaces of the stated emittance facing virtual blackbody surroundings at the same temperature as the ambient air. Values are based on a surface-air temperature difference of 10 °F and for surface temperature of 70 °F.

[d]See Chapter 3 for more detailed information, especially Tables 5 and 6, and see Figure 1 for additional data.

[e]Condensate can have a significant impact on surface emittance (see Table 3).

Table 2 Thermal Resistances of Plane Airspaces[a,b,c], °F·ft²·h/Btu

Position of Airspace	Direction of Heat Flow	Airspace Mean Temp.[d], °F	Airspace Temp. Diff.[d], °F	0.5-in. Airspace[c] Effective Emittance, E[d,e]: 0.03	0.05	0.2	0.5	0.82	0.75-in. Airspace[c] Effective Emittance, E[d,e]: 0.03	0.05	0.2	0.5	0.82
		90	10	2.13	2.03	1.51	0.99	0.73	2.34	2.22	1.61	1.04	0.75
		50	30	1.62	1.57	1.29	0.96	0.75	1.71	1.66	1.35	0.99	0.77
		50	10	2.13	2.05	1.60	1.11	0.84	2.30	2.21	1.70	1.16	0.87
Horiz.	Up ↑	0	20	1.73	1.70	1.45	1.12	0.91	1.83	1.79	1.52	1.16	0.93
		0	10	2.10	2.04	1.70	1.27	1.00	2.23	2.16	1.78	1.21	1.02
		−50	20	1.69	1.66	1.49	1.23	1.04	1.77	1.74	1.55	1.27	1.07
		−50	10	2.04	2.00	1.75	1.40	1.16	2.16	2.11	1.84	1.46	1.20
		90	10	2.44	2.31	1.65	1.06	0.76	2.96	2.78	1.88	1.15	0.81
		50	30	2.06	1.98	1.56	1.10	0.83	1.99	1.92	1.52	1.08	0.82
45° Slope	Up ↗	50	10	2.55	2.44	1.83	1.22	0.90	2.90	2.75	2.00	1.29	0.94
		0	20	2.20	2.14	1.76	1.30	1.02	2.13	2.07	1.72	1.28	1.00
		0	10	2.63	2.54	2.03	1.44	1.10	2.72	2.62	2.08	1.47	1.12
		−50	20	2.08	2.04	1.78	1.42	1.17	2.05	2.01	1.76	1.41	1.16
		−50	10	2.62	2.56	2.17	1.66	1.33	2.53	2.47	2.10	1.62	1.30
		90	10	2.47	2.34	1.67	1.06	0.77	3.50	3.24	2.08	1.22	0.84
		50	30	2.57	2.46	1.84	1.23	0.90	2.91	2.77	2.01	1.30	0.94
		50	10	2.66	2.54	1.88	1.24	0.91	3.70	3.46	2.35	1.43	1.01
Vertical	Horiz. →	0	20	2.82	2.72	2.14	1.50	1.13	3.14	3.02	2.32	1.58	1.18
		0	10	2.93	2.82	2.20	1.53	1.15	3.77	3.59	2.64	1.73	1.26
		−50	20	2.90	2.82	2.35	1.76	1.39	2.90	2.83	2.36	1.77	1.39
		−50	10	3.20	3.10	2.54	1.87	1.46	3.72	3.60	2.87	2.04	1.56
		90	10	2.48	2.34	1.67	1.06	0.77	3.53	3.27	2.10	1.22	0.84
		50	30	2.64	2.52	1.87	1.24	0.91	3.43	3.23	2.24	1.39	0.99
		50	10	2.67	2.55	1.89	1.25	0.92	3.81	3.57	2.40	1.45	1.02
45° Slope	Down ↘	0	20	2.91	2.80	2.19	1.52	1.15	3.75	3.57	2.63	1.72	1.26
		0	10	2.94	2.83	2.21	1.53	1.15	4.12	3.91	2.81	1.80	1.30
		−50	20	3.16	3.07	2.52	1.86	1.45	3.78	3.65	2.90	2.05	1.57
		−50	10	3.26	3.16	2.58	1.89	1.47	4.35	4.18	3.22	2.21	1.66
		90	10	2.48	2.34	1.67	1.06	0.77	3.55	3.29	2.10	1.22	0.85
		50	30	2.66	2.54	1.88	1.24	0.91	3.77	3.52	2.38	1.44	1.02
		50	10	2.67	2.55	1.89	1.25	0.92	3.84	3.59	2.41	1.45	1.02
Horiz.	Down ↓	0	20	2.94	2.83	2.20	1.53	1.15	4.18	3.96	2.83	1.81	1.30
		0	10	2.96	2.85	2.22	1.53	1.16	4.25	4.02	2.87	1.82	1.31
		−50	20	3.25	3.15	2.58	1.89	1.47	4.60	4.41	3.36	2.28	1.69
		−50	10	3.28	3.18	2.60	1.90	1.47	4.71	4.51	3.42	2.30	1.71

 BY: TJF 12/10/91
checked by ____

ECO #10: INSTALL INSTANTANEOUS ELECTRIC HOT WATER HEATERS
EXAMPLE CALCULATIONS

BUILDING 153:

Data:

# occupants	18	140' of 1/2" pipe.
# restrooms	5	
# sinks	1 per restroom	
# showers	0	

Water temperature at the sinks 120°F
storage tank water temperature 140°F
cold water supply temperature 66°F
circulation pump — none
source — 40 gal. dhw heater, gas-fired.
MER Rm temp = 70°F

Existing System Calculations

$$\dot{q}_1 \text{ (usage)} = .1541 \times \#\text{ occupants } \left(\frac{MBTU}{yr}\right)$$
$$= .1541 \times 18$$
$$= 2.77 \text{ MBTU/yr.}$$

$$\dot{q}_2 \text{ (pipe loss)} = 2083 \times \#\text{ occupants} \times (T_{STOR} - T_{SINK}) \times 10^{-6} \frac{MBTU}{yr.}$$
$$= 2083 \times 18 \times (140-120) \times 10^{-6}$$
$$= 0.75 \text{ MBTU/yr.}$$

$$\dot{q}_3 \left(\begin{matrix}\text{STORAGE}\\ \text{LOSS}\end{matrix}\right) = 8760 \times \left[UA\Big|_{\substack{\text{tank}\\\text{ends}}} + \frac{2\pi L}{\frac{1}{K}\ln\left(\frac{D_o}{D_i}\right) + \frac{2}{h_o D_o}} \right] \times (T_{STOR} - T_{rm})$$

D_i = storage tank diameter without insulation = 1.35 Ft.
D_o = " " " with " = 1.43 Ft.
L = Tank height = 3.72 Ft.
K = 0.021 (BTU-Ft)/hr-Ft²-°F (Fiberglass)
h_o = air film heat transfer coefficient = 0.77 (BTU/hr-°F)

$$U_{\text{top end}} = \frac{1}{R_{\text{insulation}} + R_{\text{air}}} = \frac{1}{3.14 + 0.61} = 0.267$$

$$U_{\text{BOTTOM}} = \frac{1}{R_{\text{steel}} + R_{\text{AIR}}} \simeq \frac{1}{R_{\text{AIR}}} = \frac{1}{0.92} = 1.09.$$

$$A_{\text{end}} = \frac{\pi}{4} D_o^2 = \frac{\pi}{4}(1.43)^2 = 1.61 \text{ SF.}$$

$$(U_{\text{TOP}} + U_{\text{BOTTOM}}) \times A = (.267 + 1.09) \times 1.61 = 2.34$$

$$\dot{q}_3 = 8760 \times 10^{-6} \times \left[2.34 + \frac{2\pi \times 3.72}{\frac{1}{.021} \ln\left(\frac{1.43}{1.35}\right) + \frac{2}{.77 \times 1.43}} \right] \times 70$$

$$= (1.434 + 3.145) \frac{\text{MBTU}}{\text{YR}} =$$

$$\dot{q}_3 = 4.58 \text{ MBTU/yr.}$$

$$\dot{q}_4 = 2083 \times Q \times \left(\frac{T_{\text{STOR}} + T_{\text{SINK}}}{2} - 70\right)$$

$$Q = 140' \times 0.0150 \text{ gal/ft} = 2.1 \text{ gal}$$

$$\dot{q}_4 = 2083 \times 2.1 \times 10^{-6} \left(\frac{140 + 120}{2} - 70\right) = 2083 \times 2.1 \times 60 \times 10^{-6}$$

$$\dot{q}_4 = 0.26 \text{ MBTU/yr.}$$

Total annual heat load $= \dot{q}_1 + \dot{q}_2 + \dot{q}_3 + \dot{q}_4 = 2.77 + 0.75 + 4.58 + 0.26$
$= 8.36$ MBTU

Total existing system source energy $= \frac{8.36 \text{ MBTU}}{0.65} = 12.86$ MBTU.

Total existing annual gas cost $= 12.86 \text{ MBTU} \times \$3.423/\text{MBTU}$
$= \$44.02$

Modified system:

$$\dot{q} = \dot{q}_1 = 2.77 \text{ MBTU/yr.}$$

$$\text{Source energy} = \frac{2.77 \text{ MBTU/yr}}{1.0} = 2.77 \text{ MBTU/yr}$$

$$\text{Annual energy cost} = 2.77 \times \$18.37/\text{MBTU} = \$50.88$$

$$\text{ANNUAL ECO energy cost savings} = \$44.02 - \$50.88 = (\$6.86)$$

CONCLUSION: THE ECO IS NOT ECONOMICALLY VIABLE. THERE IS A NEGATIVE ANNUAL ENERGY COST WHICH CANNOT AMORTIZE THE COST OF INSTALLATION.

BECAUSE THE COST PER MBTU FOR ELECTRICITY IS 5.37 TIMES AS MUCH AS FOR NATURAL GAS, AND BECAUSE THE ELECTRIC UNIT AFUE IS 1.538 TIMES AS HIGH AS THE GAS UNITS, THE HOT WATER USAGE COST IS 3.49 TIMES MORE EXPENSIVE FOR THE ELECTRIC UNITT. THIS LARGE DIFFERENTIAL IS NOT MADE UP BY THE STORAGE AND PIPING HEAT LOSSES OF THE GAS-FIRED SYSTEMS, WHICH AMOUNT TO ABOUT 3 TIMES THE USAGE.

EXAMPLE CALCULATION:

BLDG 254

47 OCCUPANTS

Source = gas-fired 40gal dhw heater. AFUE = 0.65

$T_{sink} = 139°F$

$T_{stor} = 140°F$

piping length is negligible.

Existing Energy Use:

$\dot{q}_1 = 2083 \times 47 \times (140-66) = 7.24$ MBTU/yr.

$\dot{q}_2 = 2083 \times 47 \times (140-139) = 0.098$ MBTU/yr.

$\dot{q}_3 =$ same as BLDG 153 $= 4.58$ MBTU/yr.

$\dot{q}_4 =$ negligible $= 0$

TOTAL LOAD = 11.92 MBTU/yr

SOURCE ENERGY $= \frac{11.92}{0.65} = 18.33$ MBTU/yr

Annual energy cost = 18.33 MBTU × # 3.423/MBTU
= #62.75

Proposal System:

$\dot{q} = \dot{q}_1 = 7.24$ MBTU/yr.

Source energy $= \dot{q} = 7.24$ MBTU/yr.

Annual energy cost = 7.24 × # 18.37/MBTU = # 133.00

ANNUAL COST SAVINGS = #62.75 − #133.00 = (#70.25)

CONCLUSION: THE ECO IS NOT FEASIBLE ECONOMICALLY.

ECO 17

BLDG 236 (GYMNASIUM):

EXISTING SERVICE HOT WATER SYSTEM DATA:

STORAGE CAPACITY: 1375 GAL. @ 160° in winter; 150° in summer.
2" calcium silicate insulation.

Heat source: steam boiler via heat converter in winter.
Two 40 gal. dom. hot water heaters in summer.

Recirc pump: 1/2 HP runs continuously.

Schedule of use: 75 showers/day, 7 days/wk @ 12 gal/shower
100 lavatory uses/day, 7 days/wk @ 0.5 gal/use

Showers: 15 in mens' locker room
5 in women's "

Lavatories: 5 in men's locker room
2 in women's locker room.

Supply + return piping: 75 FT 2" insulated pipe
200 FT 1 1/2" " "
200 FT 1" " "

ESTIMATED AFUE: BOILER/HT EXCH — 0.60
40 GAL DHW HEATERS — 0.70

HW HEAT LOADS:

1. USAGE:

showers $75/d \times 12 \text{ gal} \times 350 \text{ d/yr} = 315{,}000 \text{ gal/yr}$.

lavatories $100/d \times 0.5 \text{ gal} \times 350 \text{ d/yr} = 17{,}500 \text{ gal/yr}$

TOTAL: 332,500 gal/yr.

$$\text{USAGE LOAD} = \dot{q}\left(\frac{\text{MBTU}}{\text{yr}}\right) = 8.33 \times 332{,}500 \times (155-66) \times 10^{-6}$$
$$= 246.5 \text{ MBTU/yr}.$$

2. STORAGE LOSS:

volume (CF) = Circular area × length = $A \times L$

$L = 2 \times \text{diameter } (D_i)$

$$A = \frac{\pi D_i^2}{4}.$$

$$\text{volume in gal} = 7.48 \times \frac{\pi D_i^2}{4} \times 2D_i = 11.75\, D_i^3$$

$$D_i = \sqrt[3]{\frac{1375}{11.75}} = \sqrt[3]{117.0} = 4.9 \text{ ft}.$$

$$D_o = 4.9 + 4/12 = 5.22 \text{ ft}.$$

$$L = 2D_i = 9.8 \text{ FT}.$$

Tank ends loss: $\dot{q} = UA(T_{STOR} - T_{rm}) \times 8760$

$$U = \frac{1}{R_{ins} + R_{AIR}} = \frac{1}{3.14 + 0.68} = 0.262$$

$$A = 2 \times \frac{\pi D_o^2}{4} = \pi(5.22)^2 = 85.6 \text{ SF}.$$

$T_{rm} = 70°F$

$$\dot{q}_{\text{ends}} = 0.262 \times 85.6 \times (160-70) \times 8760 \times 10^{-6}$$
$$= 17.68 \text{ MBTU/yr}.$$

Bldg 236

CLYNDRICAL SIDES LOSS:

$$\dot{q}\,(\text{MBTU}) = \frac{2\pi L}{\frac{1}{k}\ln\left(\frac{D_o}{D_i}\right) + \frac{2}{h_o D_o}} \times 8760 \times 10^{-6} \times (90)$$

$$= \frac{2\pi\,(9.8) \times 8760 \times 90 \times 10^{-6}}{\frac{1}{.021}\ln\left(\frac{5.22}{4.9}\right) + \frac{2}{0.84 \times 5.22}} =$$

$$= \frac{48.5}{3.01 + .456} = 14.01 \text{ MBTU/yr.}$$

TOTAL STORAGE LOSS = 17.68 + 14.01 = 31.69 MBTU/yr.

3. Piping Loss; (ASHRAE 1991 A 44.4, Table 2).

~~75 Ft of 2" ins. pipe @ 29.6 BTUH/Ft x 8760 hr/yr = 19.45 MBTU~~

200 Ft of 1½" ins. pipe @ 25.4 BTUH/Ft x 8760 hr/yr = 44.50 MBTU

200 Ft OF 1" ins pipe @ 20.3 BTUH/Ft x 8760 hr/yr = 35.56 MBTU

TOTAL PIPING LOSS = 99.51 MBTU/yr.

TOTAL SYSTEM LOAD = 246.5 + 31.69 + 99.51 = 377.7 MBTU/yr.

SUMMER LOAD (MAY THRU SEP) = $\frac{5}{12}$ x 377.7 = 157.38 MBTU

WINTER LOAD (OCT THRU APRIL) = $\frac{7}{12}$ x 377.7 = 220.32 MBTU

BLDG 236

EXISTING SYSTEM SOURCE ENERGY:

N. GAS: SUMMER: $\frac{157.38}{0.70} = 224.8$

WINTER: $\frac{220.32}{0.60} = 367.2$

TOTAL = 592.0 MBTU

ELEC: $\frac{1}{12}$ HP $\times$ 0.746 $\frac{KW}{HP}$ $\times$ 8760 hr = 545 KW

$\times$ .003413 $\frac{MBTU}{KW}$

= 1.86 MBTU$_{elec}$/yr.

Annual Source Energy Cost:

N. GAS: 592.0 MBTU $\times$ \$3.423 /MBTU = \$2026.51

Elec: 1.86 MBTU $\times$ \$18.37 /MBTU = \$34.17

TOTAL ANNUAL ENERGY COST (EXISTING) = \$2,060.68

Point-of-use electric hw heaters: (345 KW connected load)

$\dot{q}_{usage}$ = 332,500 gal/yr $\times$ 8.33 $\times$ 89° $\times 10^{-6}$ = 246.5 $\frac{MBTU}{yr}$

Source energy = $\frac{246.5}{1.0}$ = 246.5 MBTU/yr.

design connected load = 1.5 gpm $\times$ 15 showers + 2 gpm $\times$ 2 sinks = 26.5 gpm

= 1590 gph

$\dot{q}$ = 8.33 $\times$ 1590 $\times$ (140 − 66) = $\frac{1.179 \text{ MBTU/hr}}{.003413 \text{ MBTU/hr-KW}}$

= 345 KW

Average daily peak demand is about 50% of the connected load,

= 345 KW/2 = 172.7 KW.

$$\text{Annual elec. cost} = \frac{246.5 \text{ MBTU/yr}}{0.003413 \frac{\text{MBTU}}{\text{KWH}}} \times \$0.0221/\text{KWH}$$

$$+ 172.7 \text{ KW demand} \times \frac{\$19.50}{\text{KW-MO}} \times 12 \text{ mo.}$$

$$= \$1,596 \text{ (energy)} + \$40,412 \text{ (demand)}$$

Annual electric cost = \$42,008 /year.

ECO Annual energy cost savings = \$2,061 − \$42,008
= (\$39,947)/yr.

Point-of-use electric heaters are not feasible for Building 236.

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JOB WSMR ESOS STUDY #1110-000
SHEET NO. 10 OF 14
CALCULATED BY TF DATE 2/25/92
CHECKED BY DATE
SCALE

ECO #10
BLDG 1621 DHW SYSTEM

Process HW load data from DEHL — Craig Brown

4 photo process machines use 95°F water

total 22,800 gal/week for 52 wks/yr
40 hr/wk shift 8 hr/day

Calculate gph of DHW:

USAGE ($\dot{q}_1$) PROCESS: $22{,}800 \frac{gal}{wk} \times \frac{1\,wk}{40\,hr} \times 8.33 \frac{LB}{gal} \times (95-66) \times 2080 \frac{hr}{yr}$

$= 286.4$ MBTU/yr

Toilets: $\dot{q}_1\Big|_{sinks} = 154{,}142 \times 45\,persons = 6.94$ MBTU/yr

$\dot{q}_1 = 286.4 + 6.94 = 293.3$ MBTU/yr

LINE LOSSES ($\dot{q}_5$)

$T_{STORAGE} = 160°$

W/ MIXING VALVE, T_{supply} at the tank = 140°

Pipe Size	Length	Loss BTUH/FT	$\dot{q}$ (BTUH)
3/4"	130'	17.7	2,300
1 1/4"	16'	23.4	375
		TOT.	2,675 BTUH $= \dot{q}_5\Big|_{toilets}$

$\dot{q}_5\Big|_{TOILETS} = 2675 \times 8760 = 23.4$ MBTU/yr.

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#1621 CONT'D.

FOR THE PHOTO PROCESS, 140° WATER IS MIXED WITH COLD WATER TO GET 95° WATER. WATER CIRCULATES CONTINUOUSLY THROUGH THE SUPPLY + RETURN PIPES:

Pipe size	Length	insulated pipe heat Loss @ 140°F	$\dot{q}_5$
2"	220'	29.6 BTUH/Ft.	6,500 BTUH
1½"	60'	25.4 "	1,500 BTUH

$\dot{q}_5 =$ 8,000 BTUH.

$$\dot{q}_5\Big|_{pipe} = 8{,}000\ \text{BTUH} \times 8760\ \frac{hr}{yr} = 70.1\ \text{MBTU/yr.}$$

700 GAL. STO. TANK LOSS

$$\dot{q}_3\Big|_{\substack{TANK\\700\,gal}} = 5.82 + \frac{200}{250} \times 1.79 = 7.25\ \text{MBTU/yr.}$$

interpolate from table on p. C-

$$\dot{q}_{TOT} = \dot{q}_1 + \dot{q}_3 + \dot{q}_5 = 293.3 + 7.25 + 70.1 + 23.4$$
$$= 394.1\ \text{MBTU/yr.}$$

$$\text{Source heat} = \frac{394.1}{0.65} = 606.3\ \text{MBTU/yr.}$$

$$\text{ELECTRICAL CONSUMPTION} = \left(\frac{1}{2}\ HP + \frac{1}{12}\ HP\right) \times .746\ \frac{KW}{HP} \times 8760\ hr = 3{,}823\ \frac{KWH}{yr.}$$
$$= 13.05\ \text{MBTU/yr.}$$

JOB

SHEET NO. 12 OF 14

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY TR DATE 2/26/92

CHECKED BY DATE

#1621

SCALE

Baseline ann. energy consumption = 606.3 MBTU (gas) + 13.0 MBTU (elec)

= 619.3 MBTU/YR

Baseline ann. energy cost:

gas — 606.3 MBTU × \$3.423/MBTU = \$2,075

elec — 3,823 KWH × \$0.0221 + .436 KW × \$19.50 × 12

= \$ 186./yr.

TOT. ANN COST = 2075 + 186 = \$2,261.

PROPOSED ECO:

USAGE = 293.3 MBTU/yr.

Source energy = 293.3 MBTU/y = 85,936 KWH.

Demand: Process: 570 gph × 8.33 × (95 − 66) = 137,695 KBH

÷ 3.413 KBH/KW = 40.3 KW.

Ann. energy cost = 85,936 KWH × \$0.0221 = \$1899

Ann. demand cost = 40.3 KW × \$19.50 × 12 = \$9,430

TOT = \$11,329/yr

ANN. ENERGY COST SAVINGS = \$2,261 − 11,329 = (\$9,068)

JOB

SHEET NO. 13 OF 14

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY TF DATE 2/24/92

CHECKED BY DATE

SCALE

Eco#10

464 40 gal tank.

$\dot{q}_1 = .154142 \times 42 \text{ people} \left(\frac{MBTU}{yr}\right) = 6.47$ MBTU/yr.

$\dot{q}_2 = 2083 \times 42 \times (130-123) \times 10^{-6} = 0.61$

$\dot{q}_3 =$ see Table on p 6. $= 4.69$

$\dot{q}_4 = 2083 \times 12.4 \left(\frac{123+130}{2} - 70\right) \times 10^{-6} = 1.46$

10.10

$\div .65 = 15.54$ MBTU/yr

392 FT @ 3/4" = 10.8 gal.
110 FT @ 1/2" = 1.6 gal.
12.4

#1558: N = 71

$\dot{q}_1 = .154142 \times 71 = 10.94$ MBTU/yr.

$\dot{q}_2 = 2083 \times 71 \times 10^{-6} (134-129) = 0.74$ MBTU/yr.

$\dot{q}_3$ (40 gal) = see table on p. 6 = 4.69 MBTU/yr.

$\dot{q}_4 = 2083 \times 4.87 \times (131.5-70) \times 10^{-6} = 0.62$ MBTU/yr.

16.99 MBTU/yr

$\div .65 = 26.14$ MBTU/yr

171 ft @ 3/4" = 4.737
9 ft @ 1/2" = 0.135 gal
4.87 gal

E M C ENGINEERS, INC.
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JOB

SHEET NO. 14 OF 14

CALCULATED BY TF DATE 2/24/92

CHECKED BY DATE

SCALE

#1794 : $N=31$

$\dot{q}_1 = .154142 \times 31 = 4.78$ MBTU/yr.

$\dot{q}_2 = 2083 \times 31 \times 10^{-6} \times (141-136) = 0.32$ MBTU/yr

$\dot{q}_3 \Big|_{40 \text{ gal}} =$ see Table on p. 6 $= 4.69$

$\dot{q}_4 = 2083 \times 8.78 \times \left(\frac{136+141}{2} - 70\right) \times 10^{-6} = 2.17$

11.96 MBTU/yr.

$\div .665 = 18.4$ MBTU/yr.

304 ft @ 3/4" = 8.42 gal
24 ft @ 1/2" = 0.36 gal
8.78 gal

ECO #10 SUPPORTING DATA.

Bldg #	Gallons	T sink	T stor.	Type	
102	120	118	125	Domestic	(RUUD)
124	STO. TANK 97 RECIRC PUMPS	125	130	"	(AOSmith)
153	40	120	140	"	(RUUD)
*236 (Gym)	1375 Storage Tank	127	160	Steam to HW Convertor	
254	40	139	140	Domestic	(AO Smith)
260 (PX)	40	130	136	"	(RUUD)
300	40	125	132	"	(AOSmith)
"	50	124	130	"	(Bradford-White)
"	60	129	136	"	(Rheem)
380	40	118	127	"	(Rheem)
464	40	123	130	"	(AO Smith)
1504	40	128	134	"	(AOSmith)
1506	80	110	122	"	(Rheem)
"	40	NOT OPERATING		"	(A O Smith)
1512	85	107	127	"	(RUUD)
"	85	NOT OPERATING		"	(RUUD)
1526	40	NOT USED		"	(Rheem)
"	40			"	(Bradford-White)
1528	? 40	133	145		
1530	40	128	136	"	(Reliance)
1558	40	129	134		
1621	100 (100 Gallon Storage tank)	158	160	"	(Dayton)
1622	40	126	136		(Republic)
1624	40	126	133		(AOSmith)
"	40	118	123		(RUUD)
"	40	123	130		(Reliance)
1751	100	142	150		(Day & Night)
1753	40	135	135		(Rheem)
1790	40	132	136		
1794	40	136	141		(Rheem)
21140	6	120	120		(AOSmith)
* 236 Summer	40		160	Commercial	
"	40		160	"	

Bldg. No.	Occupants	Sinks	Bathrooms	
102	110	4	4 womens	1-1-1-1
		6	4 mens	2-2-1-1
124	129	16	4, 1st floor	6-6-2-2
		16	4, 2nd floor	6-6-2-2
		16	4, 3rd floor	6-6-2-2
		6	3, Basement	2-2-2
		6 JC		
153	18	1	women	
		3	mens	
236	15	8	2 restrooms (6+2)	
		15 SHOWERS		
254	47	6	4 restrooms	2-2-1-1
260	35	5 (1 Janitors)	4 "	2-1-1-1
300	281			
380	6	12	9	1-1-2-2-1-1-1-1
464		7	7	3-1-1-1-1
1504	100	10	4	3-2-3-2
1506	129	25	10	3-3-3-3-3 2-2-2-2-2
1512	35	18	8	3-2-2-1-3-2-3-2
1526	200	11	7	3-2-2-2-1-1
1528	100	11	4	3-3-3-2
1530	225	26	10	5-5-2-2-2-2-2-2-2-2

Bldg #	Occupants	Sinks	Bathrooms	
1558		3	2	2 - 1
1621	45	5	2	3 - 2
1622	100	25	10	4 - 3 - 3 - 3 - 2 - 2 - 2 - 2 - 2 - 2
1624	130	25	8	5 - 5 - 3 - 3 - 3 - 2 - 2 -
1751	25	7	2	6 - 1
1753	≈ 15-20	4	2	2 - 2
1790	≈ 15-20	8	2	6 - 2
1794		7 (4 showers)	2	5 - 2 sinks 3 - 1 showers
~~2140~~	~~6~~	~~2~~	~~2~~	

JOB WSMP

SHEET NO. 4 OF 12

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY K Coddington DATE 1-7-?

CHECKED BY DATE

SCALE

Pipe Length & Size determination

For Building 380

On this building, we didn't have a mechanical print for hot water plumbing. To estimate the length, I followed the drainage piping. These pipes went to each basin, thus accounting for the length.

$$L = 423' \Rightarrow d = 1.00''$$

for the size I had to estimate an average size used in most buildings

For Building 153

Determined from Mechanical Plumbing Print

$L = 173'$ Pipe Size = 1/2"

For Building 124

Determined from Mechanical Plumbing Print

Pipe Size	Length
1 1/2"	144
1 1/4"	10
1 "	112
3/4 "	322

E M C ENGINEERS, INC.

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JOB USMC

SHEET NO. 5 OF 12

CALCULATED BY K. Coddington DATE 1-7-9?

CHECKED BY DATE

SCALE

For Building 1621

Determined from Plumbing Drawing

Size	Length
3/4"	130'
1.25"	16'

For Building 1558

For this 1 story Building, with no plumbing plans, I took a 3/4" line down the length of the building. This would go to the restroom, kitchen, & dining room. Then a 1/2 in line to each basin.

Size	Length
3/4"	171'
1/2"	9'

For Building 1528

There were no plumbing plans for this building. Took a 2" line down length of each floor, A 1" line down length of each floor, and a 1/2" line to the restrooms.

Size	Length
2"	296
1"	276
1/2"	48

⇒ also took 2" line up building → risers

JOB WSMR

SHEET NO. 6 OF 12

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY KC DATE 1-7-92

CHECKED BY DATE

SCALE

For Building 1520

No Plumbing Plans

- 2' down length
- 1" down length
- 1/2" to toilets
- 2" up risers

Size	Length
2"	308
1"	288
1/2"	266

For Building 1504

No Plumbing Plans

- 2" down length
- 1" down length
- 1/2" to basins
- 2" up risers

Size	Length
2"	225
1"	215
1/2"	250

E M C ENGINEERS, INC.

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JOB WSMR

SHEET NO. 7 OF 12

CALCULATED BY KC DATE 1-7-92

CHECKED BY DATE

SCALE

For Building 1622

No Plumbing Plans → 3 floors & penthouse

- 2" down length of each floor & uprisers
- 1" down length of each floor
- 1/2" to bathrooms

Size	Length
2"	748
1"	702
1/2"	288

For Building 1794

No Plumbing Plans → 1 floor

- 3/4" down length
- 1/2" to basins

Size	L
3/4	304
1/2	24

For Building 260

No. Plumbing Plans → 1 floor

- 3/4" down length
- 1/2" to restrooms

Size	Length
3/4	136
1/2	113

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JOB: WSMR
SHEET NO. 8 OF 12
CALCULATED BY: KC DATE: 1-7-92
CHECKED BY: DATE:
SCALE:

For Building 236

No Plumbing Plans
- 2" line down length & up risers
- 1" line down length
- 1/2" line to basins

Size	Length
2"	208
1"	144
1/2"	60

For Building 464

No Plumbing Plans - 1 floor
- 3/4" line down length
- 1/2" line to basins

Size	Length
3/4	392
1/2	110

For Building 254

No Plumbing Plans - 2 floors
- 2" down length
- 1" down length
- 1/2" to basins

Size	Length
2"	147
1"	147
1/2"	20

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JOB WSMR
SHEET NO. 9 OF 12
CALCULATED BY KO DATE 1-7-92
CHECKED BY DATE
SCALE

For Building 108

No Plumbing Plans
- 2" line down length & up risers
- 1" line down length
- 1/2" line to basins

Size	Length
2"	282
1"	241
1/2"	172

For Building 1751

No Plumbing Plans - 1 floor
- 3/4" down length
- 1/2" to basins

Size	Length
3/4"	225
1/2"	52

For Building 1752

No Plumbing Plans - 1 floor
- 3/4" down length
- 1/2" to basins

Size	Length
3/4"	178
1/2"	15

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Denver • Colorado Springs • Atlanta • West Germany

JOB WSMR

SHEET NO. 10 OF 12

CALCULATED BY KC DATE Jan 7

CHECKED BY ______ DATE ______

SCALE ______

For Building 1512

No Plumbing Plans

- 2" line down length & up risers
- 1" line down length
- 1/2" line to basins

Size	Length
2"	737
1"	717
1/2"	236

For Building 1506

No Plumbing Plans

- 2" line down length & up risers
- 1" line down length
- 1/2" line to basins

Size	Length
2"	725
1"	705
1/2"	411

E M C ENGINEERS, INC.

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CALCULATED BY KC DATE [illegible]

CHECKED BY DATE

SCALE

For Building 1624

From Plans

East Wing

Size	Length
1"	101

North & South Wings

Size	Length
1"	174

For Building 1526

No Plumbing Plans

- 2" line down length & up risers
- 1" line down length
- 1/2" line to basins

Size	Length
2"	340
1"	320
1/2"	64

For Building 1790

No Plumbing Plans

- 2" line down length & up Risers
- 1" line down length

Size	Length
2"	4[illegible]
1"	440

E M C ENGINEERS, INC.

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JOB WSMC

SHEET NO. 12 OF 12

CALCULATED BY KC DATE 1-7-92

CHECKED BY ______ DATE ______

SCALE ______

For Building 300

Original & Wings → No Plumbing Plans
- 2" down length & up Risers
- 1" line down length
- 1/2" line to basins

Original - South Wing

Size	Length
2"	270
1"	222
1/2"	82

East & West Wings

Size	Length
2"	101
1"	101
1/2"	32

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF

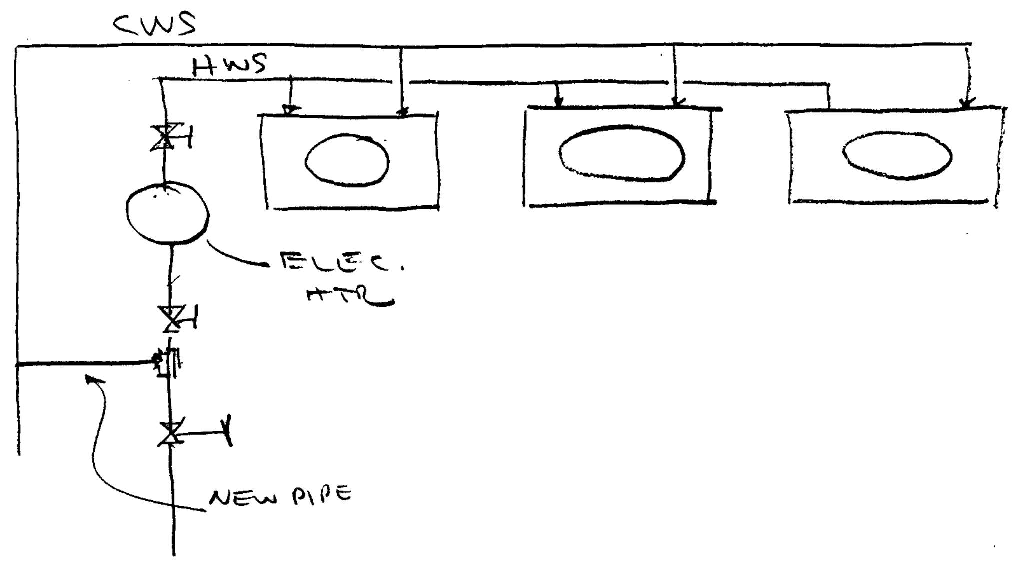
CALCULATED BY TF & MS DATE 3/12/92

CHECKED BY DATE

SCALE

ECO #10: ELEC. POINT-OF-USE WATER HEATERS

TYPICAL INSTALLATION



APPURTENANCE MATERIAL & LABOR PER INSTALLATION (W/ OH+P)
SOURCE: MEANS MECH & ELEC COST GUIDES, 1992

1/2" GATE VLVS	3 @	× 25.00	=	$75.00
COPPER PIPE	10'	× 5.00	=	50.00
WIRING	75'	× 3.07	=	230.00
CIRCUIT BREAKER	1	× 65.00	=	65.00
JUNCTION BOX	1	× 10.00	=	10.00
SWITCH BOX	1	× 20.00	=	20.00
ELE. HEATER LABOR ONLY		38.00	=	38.00

TOTAL COST W/O HEATER PER INSTALLATION $488.00

JOB

SHEET NO. 2 OF 6

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY TF DATE 2/24/92

CHECKED BY DATE

SCALE

HEAT LOAD:

1 BASIN (OFFICE BLDG) $\dot{q} = 2gph \times 8.33 \frac{LB}{gal} \times (140-66) = 1233$ BTUH
.361 KW

1 Service sink $\dot{q} = 20gph \times 8.33 \times (74) = 12,328$ BTUH
3.61 KW

1 SHOWER (GYM) $\dot{q} = 225 \times 8.33 \times (74) = 138,695$ BTUH
40.6 KW.

BLDG	# OCCUPANTS	Rest Rm		Sinks	HTR GPM	HTR KW	# HTRS
102	110	Women's	4@	4	.133	1.45	4
		MEN	4@	6	.20	2.17	4
		Serv. sink	2@	1	.333	3.61	2
124	129	RR	3@	1	.033	0.36	3
		RR	6@	2	.066	0.72	6
		RR	6@	3	.099	1.08	6
		Serv. sinks	6@	1	.333	3.61	6
153	18		1@	1	.033	0.36	1
			1@	3	.100	1.08	1
		Serv. sink	1@	1	.333	3.60	1
236	—	men's	1@	6 sinks	0.20	5.30	1
			1@	13 showers	4.33		
		women's	1@	2 sinks	.067	8.0	1
			1@	2 showers	.667		
		Serv. sink	1@	1	.333	3.61	1
254	47		2@	2 sinks	.067	0.72	2
			2@	1 sink	.033	0.36	2
		Service sink	2@	1	.333	3.61	2

JOB

SHEET NO. 3 OF 6

E M C ENGINEERS, INC.

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CALCULATED BY TF DATE 2/24/92

CHECKED BY DATE

SCALE

BLDG	# OCCUPANTS	Rest Rms	Sinks	HTR GPM	HTR KW	# HTRS
260	35	4 @	1	0.033	0.36	4
		Service Sink	1	.333	3.61	1
300 E	281	3 @ 2		.067	0.72	3
		3 @ 1		.033	0.36	3
		3 serv. sinks		.333	3.61	3
300 S		6 @ 3		.100	1.08	6
		3 serv. sink		.333	3.61	3
300 W		3 serv. sink		.333	3.61	3
		3 @ 2		.067	0.72	3
		3 @ 1		.033	0.36	3
350	6	3 @	2	0.067	0.72	3
		6 @	1	0.033	0.36	6
		1 Service sink		0.333	3.61	1
464	122	4 @	1	0.033	0.36	4
		1 @	3	0.100	1.08	1
		1 service sink		0.333	3.61	1
1504	100	2 @	3	0.100	1.08	2
		2 @	2	0.067	0.72	2
		1 service sink		0.333	3.61	1
1506	129	5 @	2	0.067	0.72	5
		5 @	3	0.100	1.08	5
		2 service sinks		0.333	3.61	2
1512	35	3 @	3	0.100	1.08	3
		4 @	2	0.067	0.72	4
		1 @	1	0.033	0.36	1
		3 service sinks		0.333	3.61	3

JOB

SHEET NO. 4 OF 6

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY TF DATE 2/24/92

CHECKED BY DATE

SCALE

BLDG	# OCCUPANTS	Rest Rooms	Sinks	HTR GPM	HTR KWH	# HTRS
1526	200	4 @ 2		0.067	0.72	4
		3 @ 1		0.033	0.36	3
		6 service sinks		.333	3.61	1
1528	100	1 @ 4		0.133	1.45	1
		1 @ 3		0.100	1.08	1
		2 @ 2		0.067	0.72	2
		4 service sinks		.333	3.61	4
1530	225	2 @ 5		0.165	1.80	2
		8 @ 2		0.067	0.72	8
		6 service sinks		.333	3.61	6
1558		4 photo machines @ 0.933 gpm			10.1 KW	4
		1 @ 2		0.067	0.72	1
		1 @ 1		0.033	0.36	1
		1 service sink		0.333	3.61	1
1621	45	4 photo machines @ 5 gpm				
		1 @ 3		0.10	1.08	1
		1 @ 2		0.067	0.72	1
		1 service sink		0.333	3.61	1
1622	100	1 @ 4		0.133	1.45	1
		3 @ 3		0.100	1.08	3
		6 @ 2		0.067	0.72	6
		6 service sinks		0.333	3.61	6
1624	130	2 @ 5		0.165	1.80	2
		3 @ 3		0.100	1.08	3
		3 @ 2		0.067	0.72	3
		6 service sinks		0.333	3.61	6

JOB

SHEET NO. 5 OF 6

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY DATE

CHECKED BY DATE

SCALE

BLDG	#OCCUPANTS	Rest Rm Sinks	HTR GPM	HTR KW	# HTRS
1751	25	1 @ 4	0.133	1.45	1
		1 @ 3	0.100	1.08	1
		1 service sink	0.333	3.61	1
1753	18	2 @ 2	0.067	0.72	2
		1 service sink	0.333	3.61	1
1790	18	2 @ 4	0.133	1.45	2
		1 service sink	0.333	3.61	1
1794	31	1 @ 4 + 2 showers	7.63	82.6	1
		1 @ 3 + 2 showers	7.60	82.3	1
		1 service sink	0.333	3.61	1

E M C ENGINEERS, INC.	JOB WSMR ESOS #1110-000
Denver • Colorado Springs • Atlanta • West Germany	SHEET NO. 1 OF 2
	CALCULATED BY TJF DATE 6/11/92
	CHECKED BY ______ DATE ______
ECO #10 : BLDG P124	SCALE ______

DATA SOURCE — BUILDING MANAGER

		# HEATERS	CALCULATED SIZE (KW)	CATALOG SIZE (KW)
BASEMENT	3 RR @ 1 SINK	3	0.36	1
FIRST FLOOR	2 RR @ 2 SINKS	2	0.72	1
	2 RR @ 3 SINK	2	3.6	3
	2 SERVICE SINKS	2	0.36	1
SECOND FLR	2 RR @ 2 SINKS	2	0.72	1
	2 RR @ 3 SINKS	2	1.08	1
	2 SERVICE SINKS	2	3.6	3
THIRD FLR	2 RR @ 2 SINKS	2	0.72	1
	2 RR @ 3 SINKS	2	1.08	1
	2 SERVICE SINKS	2	3.6	3
	TOTAL	21		

15 HEATERS @ 1 KW

6 HEATERS @ 3 KW

JOB WSMR ESOS #1110-000

SHEET NO. 2 OF 2

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY TF DATE 6/11/92

CHECKED BY ______ DATE ______

ECO #10; BLDG P124

SCALE ______

ELECTRICAL ENERGY SAVINGS CALCULATIONS;

$\frac{1}{12}$ HP PUMP $\times 0.746 \frac{kW}{HP} \times 8760 \frac{HR}{YR} = 555$ kWh/yr.

$\frac{1}{6}$ HP PUMP $\times 0.746 \quad \times 8760 = 1,111$ kWh/yr

TOTAL PUMP ELEC ENERGY SAVED = 1,666 kWh/yr

CONSUMPTION OF ELEC WATER ~~HEATER~~:

$0.154142 \frac{MBtu}{person\text{-}yr} \times 129 \text{ PEOPLE} = 19.9 \frac{MBtu}{YR}$

$\div .003413 \frac{MBtu}{kWH} = 5,826 \frac{kWh}{yr}$

Total ANNUAL kWh SAVED = 1,666 − 5,826

= 4,160 kWh/yr

$\times .003413 \frac{MBtu}{kWh} = \left(14.2 \frac{MBtu}{YR}\right)$

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 6 OF 6

CALCULATED BY TF DATE 2/24/92

CHECKED BY ____ DATE ____

SCALE ____

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

ECO #10

SIZING ELEC POINT-OF-USE HEATERS.

REF: ASHRAE 1991 APPLICATIONS HB, SECT 44, TABLE 8.

Table 8 Hot Water Demand per Fixture for Various Types of Buildings (Gallons of water per hour per fixture, calculated at a final temperature of 140°F)

	Apartment House	Club	Gymnasium	Hospital	Hotel	Industrial Plant	Office Building	Private Residence	School	YMCA
1. Basins, private lavatory	2	2	2	2	2	2	2	2	2	2
2. Basins, public lavatory	4	6	8	6	8	12	6	—	15	8
3. Bathtubs	20	20	30	20	20	—	—	20	—	30
4. Dishwashers[a]	15	50–150	—	50–150	50–200	20–100	—	15	20–100	20–100
5. Foot basins	3	3	12	3	3	12	—	3	3	12
6. Kitchen sink	10	20	—	20	30	20	20	10	20	20
7. Laundry, stationary tubs	20	28	—	28	28	—	—	20	—	28
8. Pantry sink	5	10	—	10	10	—	10	5	10	10
9. Showers	30	150	225	75	75	225	30	30	225	225
10. Service sink	20	20	—	20	30	20	20	15	20	20
11. Hydrotherapeutic showers				400						
12. Hubbard baths				600						
13. Leg baths				100						
14. Arm baths				35						
15. Sitz baths				30						
16. Continuous-flow baths				165						
17. Circular wash sinks				20	20	30	20		30	
18. Semicircular wash sinks				10	10	15	10	15		
19. DEMAND FACTOR	0.30	0.30	0.40	0.25	0.25	0.40	0.30	0.30	0.40	0.40
20. STORAGE CAPACITY FACTOR[b]	1.25	0.90	1.00	0.60	0.80	1.00	2.00	0.70	1.00	1.00

[a]Dishwasher requirements should be taken from this table or from manufacturers' data for the model to be used, if this is known.
[b]Ratio of storage tank capacity to probable maximum demand/h. Storage capacity may be reduced where an unlimited supply of steam is available from a central street steam system or large boiler plant.

19. The heater or coil should have a water-heating capacity equal to this probable maximum demand. The storage tank should have a capacity equal to the probable maximum demand multiplied by the storage capacity factor in line 20.

affecting the spray pattern of the shower head. Flow control valves are commonly available in capacities from 1.5 to 4.0 gpm.

If the manufacturer's flow rate for a shower head is not available and a flow control valve is not used, the following may serve as a guide for sizing the water heater:

Small shower head	2.5 gpm
Medium shower head	4.5 gpm
Large shower head	6 gpm

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #13 – P1743 – ENERGY EFFICIENT LIGHTING FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$26,824	
B. SIOH COST	(5.5% of 1A) =		$1,475	
C. DESIGN COST	(6.0% of 1A) =		$1,609	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$29,909	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		——————>	$29,909

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	119	$772	15.23	$11,765	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		119	772.5		——————>	$11,765

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $3,701

1 DISCOUNT FACTOR (From Table A–2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $54,333

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $54,333

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $3,882

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.52

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$4,474
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$66,098
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.21
7 SIMPLE PAYBACK (SPB)	(1F/4) =	6.69

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #13 – P1751 – ENERGY EFFICIENT LIGHTING FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$9,515	
B. SIOH COST	(5.5% of 1A) =		$523	
C. DESIGN COST	(6.0% of 1A) =		$571	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$10,609	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		——————>	$10,609

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	38	$246	15.23	$3,743	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		38	245.8		——————>	$3,743

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$1,177	
1 DISCOUNT FACTOR	(From Table A–2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$17,286	

B. NON–RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON–ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$17,286
D. PROJECT NON–ENERGY TEST			
1 25% MAXIMUM NON–ENERGY CALCULATION	(2F5 x 0.33) =	$1,235	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.47	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$1,423
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$21,028
6 DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.98
7 SIMPLE PAYBACK (SPB)	(1F/4) =	7.45

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #13 - S1753 - ENERGY EFFICIENT LIGHTING			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/09/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$7,396	
B. SIOH COST	(5.5% of 1A) =		$407	
C. DESIGN COST	(6.0% of 1A) =		$444	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$8,247	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		---------->	$8,247

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	27	$174	15.23	$2,652	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		27	174.1		---------->	$2,652

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$834	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$12,246	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$12,246
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$875	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.43	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$1,008
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$14,898
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.81
7 SIMPLE PAYBACK (SPB)	(1F/4) =	8.18

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #13 – P1790 – ENERGY EFFICIENT LIGHTING			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/09/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$9,643		
B. SIOH COST	(5.5% of 1A) =	$530		
C. DESIGN COST	(6.0% of 1A) =	$579		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$10,752		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	——————>	$10,752	

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	57	$369	15.23	$5,624	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		57	369.3		——————>	$5,624

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $1,769

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $25,973

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $25,973

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,856

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.70

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$2,139
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$31,597
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.94
7 SIMPLE PAYBACK (SPB)	(1F/4) =	5.03

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range | REGION: 4 | PROJECT NO: DACA 63-91-C-0152

PROJECT TITLE: ECO #13 - P1794 - ENERGY EFFICIENT LIGHTING | FISCAL YEAR: 1992

DISCRETE PORTION NAME: TOTAL

ANALYSIS DATE: 06/09/92 | ECONOMIC LIFE: 25 | PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$24,962	
B. SIOH COST	(5.5% of 1A) =		$1,373	
C. DESIGN COST	(6.0% of 1A) =		$1,498	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$27,833	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		----------->	$27,833

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	135	$875	15.23	$13,322	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		135	874.7		----------->	$13,322

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$4,191	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$61,523	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$61,523
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$4,396	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.64	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$5,066
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$74,845
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.69
7 SIMPLE PAYBACK (SPB)	(1F/4) =	5.49

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #13 – P1830 – ENERGY EFFICIENT LIGHTING FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A.	CONSTRUCTION COST	=	$12,211	
B.	SIOH COST	(5.5% of 1A) =	$672	
C.	DESIGN COST	(6.0% of 1A) =	$733	
D.	ENERGY CREDIT	(1A + 1B + 1C) =	$13,615	
E.	SALVAGE VALUE	=	$0	
F.	TOTAL INVESTMENT	(1D – 1E) =	————>	$13,615

2 ENERGY SAVINGS (+) / COST (–)

	FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	$6.48	46	$296	15.23	$4,505	
B.	DIST		0	$0	17.28	$0	
C.	NAT GAS	$2.21	0	$0	19.64	$0	
D.	PAPER		0	$0		$0	
E.	COAL			$0	16.22	$0	
F.	TOTAL		46	295.8		————>	$4,505

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $1,417
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $20,807

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $20,807

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,487
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.44
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$1,713
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$25,312
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.86
7	SIMPLE PAYBACK (SPB)	(1F/4) =	7.95

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #13 – P1845 – ENERGY EFFICIENT LIGHTING			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/09/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$281	
B. SIOH COST	(5.5% of 1A) =		$15	
C. DESIGN COST	(6.0% of 1A) =		$17	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$313	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$313

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	1	$7	15.23	$112	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		1	7.3		————>	$112

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$35	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$515	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$515
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$37	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.47	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$42
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$627
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.00
7 SIMPLE PAYBACK (SPB)	(1F/4) =	7.38

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1743	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	146	2.19	319.74	0.09	27.60	354.60		$674.34
	8 FT. ENERGY EFFICIENT LAMPS	EA	114	5.12	583.68	0.09	27.6	276.88		$860.56
	ENERGY EFFICIENT BALLASTS									
	2-LAMP (4') FIXTURE BALLAST	EA	73	14.06	1026.38	0.85	27.6	1714.59		$2,740.97
	2-LAMP (8') FIXTURE BALLAST	EA	57	29.68	1691.76	0.85	27.6	1338.79		$3,030.55
	8 FT, 2-TUBE FLUORESCENT FIXTURES	EA	70	141.24	9886.80	1.82	27.6	1932.00		$11,818.80
	LIGHTING BRANCH CIRCUITS	EA	7	LABOR AND MATERIALS 930.45	6513.15					$6,513.15
	DEMOLITION	EA	118	LABOR AND MATERIALS 10.05	1185.90					$1,185.90
	TOTAL THIS SHEET									$26,824.29

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1751

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST		LABOR COSTS			Other Direct Costs (9)	Line Total (10)
				Unit (4)	Total (5)	Manhours Mandays (6)	Average Rate (7)	Total (8)		
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT, ENERGY EFFICIENT LAMPS	EA	398	2.19	871.62	0.09	27.60	966.66		$1,838.28
	8 FT, ENERGY EFFICIENT LAMPS	EA	6	5.12	30.72	0.09	27.60	14.57		$45.29
	ENERGY EFFICIENT BALLASTS									
	2-LAMP (4') FIXTURE BALLAST	EA	199	14.06	2797.94	0.85	27.60	4674.03		$7,471.97
	2-LAMP (8') FIXTURE BALLAST	EA	3	29.68	89.04	0.85	27.60	70.46		$159.50
	TOTAL THIS SHEET									$9,515.05

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

Form Approved
Budget Bureau No. 22-R-100

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1753	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	66	2.19	144.54	0.09	27.60	160.30		$304.84
	ENERGY EFFICIENT BALLASTS	EA	33	14.06	463.98	0.85	27.60	775.09		$1,239.07
	METAL HALIDE FIXTURES & LAMPS	EA	12	308.40	3700.80	0.33	27.60	331.20		$4,032.00
	LIGHTING BRANCH CIRCUITS	EA	2	LABOR AND MATERIALS 779.52	1559.04					$1,559.04
	DEMOLITION	EA	26	LABOR AND MATERIALS 10.05	261.30					$261.30
	TOTAL THIS SHEET									$7,396.25

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1790

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	40	2.19	87.6	0.09	27.60	97.15		$184.75
	ENERGY EFFICIENT BALLASTS	EA	20	14.06	281.20	0.85	27.60	469.75		$750.95
	REPLACE EXISTING 400-WATT INCANDESCENTS WITH 325-WATT METAL HALIDE LAMPS									
	METAL HALIDE FIXTURES & LAMPS	EA	84	86.75	7287.00	0.33	27.60	765.07		$8,052.07
	EXISTING INCANDESCENT REMOVAL	EA	84			0.17	27.60	394.13		$394.13
	DEMOLITION	EA	26	LABOR AND MATERIALS 10.05	261.30					$261.30
	TOTAL THIS SHEET									$9,643.20

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1794	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	12	2.19	26.28	0.09	27.60	29.15		$55.43
	ENERGY EFFICIENT BALLASTS	EA	6	14.06	84.36	0.85	27.60	140.93		$225.29
	250-W METAL HALIDE FIXTURES & LAMPS	EA	48	308.4	14803.20	EA	65.14	3126.72		$17,929.92
	LIGHTING BRANCH CIRCUITS	EA	8	LABOR AND MATERIALS 723.36	5786.88					$5,786.88
	DEMOLITION	EA	96	LABOR AND MATERIALS 10.05	964.80					$964.80
	TOTAL THIS SHEET									$24,962.31

Material Source: Lightbulb Supply Co., Denver, CO; Prices include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and includes Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1830

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST		LABOR COSTS			Other Direct Costs (9)	Line Total (10)
				Unit (4)	Total (5)	Manhours Mandays (6)	Average Rate (7)	Total (8)		
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	522	2.19	1143.18	0.09	27.60	1267.83		$2,411.01
	ENERGY EFFICIENT BALLASTS	EA	261	14.06	3669.66	0.85	27.60	6130.26		$9,799.92
	TOTAL THIS SHEET									$12,210.94

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1845	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	12	2.19	26.28	0.09	27.60	29.15		$55.43
	ENERGY EFFICIENT BALLASTS	EA	6	14.06	84.36	0.85	27.60	140.93		$225.29
	TOTAL THIS SHEET									$280.71

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

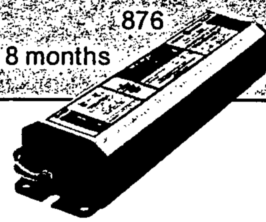
Energy savings realized with Maxi-Miser systems...

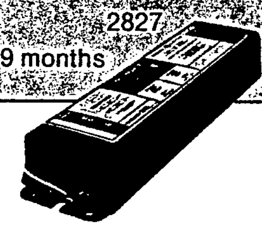
compared to standard systems can pay back the added initial investment in less than two years in most new installations.

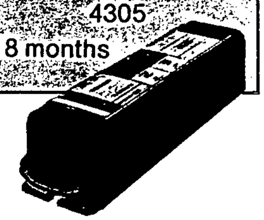
Other operating costs, such as ballast replacement or air conditioning costs, may also be lower depending on the application.

MAXI-MISER SYSTEM	F40	F96SL	F96HO
FIXTURE TYPE	4 Lamp Troffer	2 Lamp Strip	2 Lamp Industrial
AREA—SQUARE FEET	10,000	20,000	50,000
ANNUAL OPERATING HOURS	4,000	6,000	4,500
Added Initial Cost*	$566	$2011	$6572
Operating Cost Savings*	876	2827	4305
Simple Payback Period	8 months	9 months	18 months

*Numbers shown are for illustration only based on a 4¢/kwh energy rate. Values will vary depending on actual energy rate, equipment costs and application.







MAXI-MISER SYSTEM PERFORMANCE VS. STANDARD SYSTEMS*

System	Relative Light Output	Input Watts	Watts Saved	Efficiency Lumen Output per Watt (LPW)	Efficiency Increase	Relative Cost-of-Light
F40 Rapid Start						
Standard	100	88		59		1.00
Maxi-Miser	104	74	16%	73	24%	.90
F96 Slimline						
Standard	100	172		69		1.00
Maxi-Miser	100	136	21%	86	25%	.90
F96 High Output						
Standard	100	253		70		1.00
Maxi-Miser	99.4	211	17%	84	19%	.92

*Data based on fixture tests conducted with center rated products in 77°F ambient, F40 – 4 lamp recessed troffer, slimline – 2 lamp strip, high output – 2 lamp industrial.

The Maxi-Miser System

SPECIFICATIONS AND DATA								
LAMP...WATT-MISER II	BALLAST...MAXI-MISER II							
ORDERING CODE	CATALOG NUMBER	NUMBER OF LAMPS	LINE VOLTAGE	LINE CURRENT○	INPUT WATTS▲	SOUND RATING	UNITS CASE■	GENERAL DATA
F40LW/RS/WM	8G1028W 8G1078W 8G1038W 8G1088W	2 1 2 1	120 120 277 277	.65 .38 .29 .17	78 46 79 48	A A A A	20 20 20 20	UL Listed★–Yes Performance–ETL Certified† Protection–Bonus Line Class P Capacitor–Non PCB Protected Power Factor–above 90% Frequency–60 Hertz Min. Start–60°F Temp.
F96T12LW/WM	8G1008W 8G1018W	2 2	120 277	1.2 .51	136 135	C C	6 6	
F96T12LW/HO/WM	8G1148W 8G1158W	2 2	120 277	1.73 .75	212 213	B B	6 6	

○ With 35-Watt Lamps.

■ Bulk packed. To obtain individual pack, add suffix F to catalog number. Individual Pack F40-10/Case.

★ Maxi-Miser II UL listed for use with standard or energy saving lamps. See label.

▲ Lamps and Ballast tested in 77°F. Data for fixture test will vary.

† ETL Certification of performance to specifications in ETL. Procedure B20.2 with test methods per American National Standard C82.2.

Application Recommendation: The Maxi-Miser II ballast is intended for use in lamp ambients of 60°F or higher [redacted]

GUIDE SPECIFICATION – F40
Ballast shall be General Electric Maxi-Miser II or approved equal and shall be useable with F40 Lite White energy saving lamps as approved by the lamp manufacturer. Ballast performance with such lamps shall be certified by a nationally recognized independent testing laboratory with a United States government registered certification mark for fluorescent lamp ballasts. Performance certification shall be conducted per ETL procedure B20.2 in accordance with American National Standard C82.2 test methods.

- Ballast nameplate shall show *certified* input watts and relative light output with *energy saving, high efficiency lamps.* The relative light output shall be 95% with a tolerance of +5 to −2½%.
- Ballast case temperature shall not exceed 90°C.
- Ballast shall be equipped with UL component recognized non-PCB protected capacitors and a core and coil protector as in Bonus Line® dual protection.
- Ballast shall be high power factor, UL listed Class P.
- Ballast shall be warranted for three years.

PRODUCT CERTIFICATION
Many commercial and industrial lighting fixtures contain ballasts which are certified for use with specific lamps in a program sponsored by the Certified Ballast Manufacturers (CBM) Association. An independent organization, ETL Testing Laboratories, Inc., (ETL) is used by CBM to conduct certification tests to certain performance and safety standards. These standards are based upon lamp and ballast specifications established by ANSI.

In order to be CBM certified, one requirement is that the ballast deliver at least 92.5% (95% on some lamps) of the light output delivered by a standard reference test reactor used to establish rated lamp requirements. This CBM certification program requires that there be approved ANSI standards for the specific lamps with which the ballasts are being certified.

As yet no ANSI standards exist for fluorescent energy saving lamps. Therefore, General Electric has proceeded to obtain an independent certification that the Maxi-Miser II ballasts with Watt-Miser II lamps provide the minimum relative light output shown on the product label. In addition, separate tests conducted by General Electric show Maxi-Miser II relative light output is equal to or greater than standard lamps and ballasts when tested in most typical fixture installations.

The independent laboratory certification of the Maxi-Miser II ballasts is performed by ETL in accordance with ETL procedure B20.2 with test methods per ANSI C82.2. This separate certification program includes continuing unannounced audit of General Electric's Maxi-Miser II ballasts by ETL.

100 Years of Progress for People

212-9124 8/79

GENERAL ELECTRIC

Printed in U.S.A.

Fluorescent Ballasts Jump Start Energy Efficiency

Energy-saving standard ballasts use higher-quality components than standard ballasts, limiting internal losses, lowering input watts and improving system efficiency.

By PAULA S. ANDREWS, P.E.
Senior Lighting Designer
Newcomb & Boyd, Atlanta

Energy efficiency in electrical systems has become increasingly important as concerns mount about costs and environmental effects of wasting energy. One area where this is particularly true is lighting. According to the Environmental Protection Agency (EPA), as much as 80% to 90% of electrical energy in the United States is spent on lighting.

Clearly, it makes sense both environmentally and economically to maximize the performance of lighting systems. The lighting industry is addressing this issue with new products and the refinement of old standards.

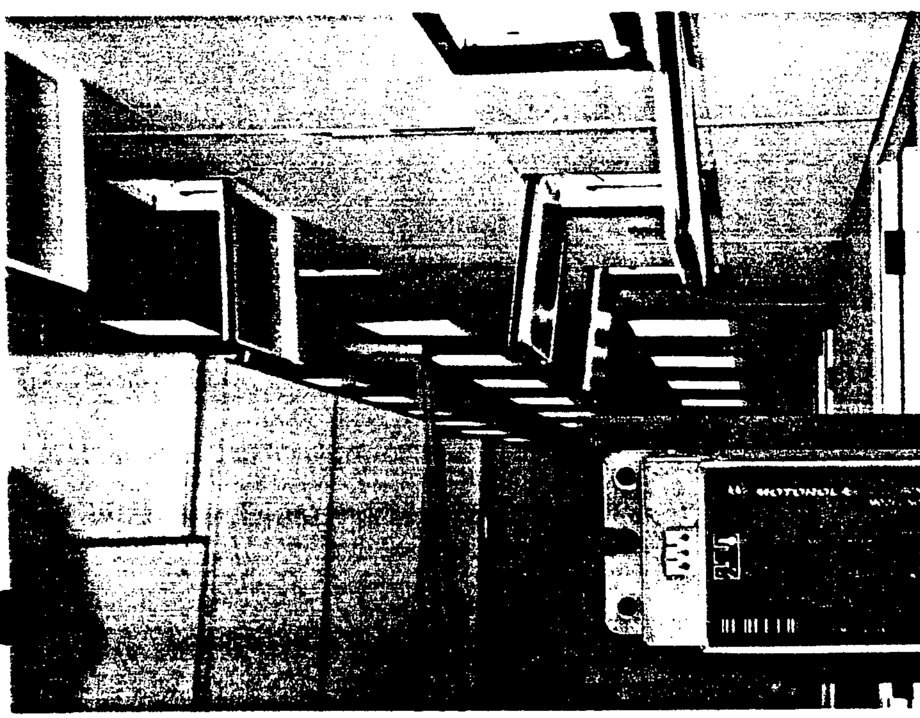
At the center of these changes is the fluorescent lamp ballast.

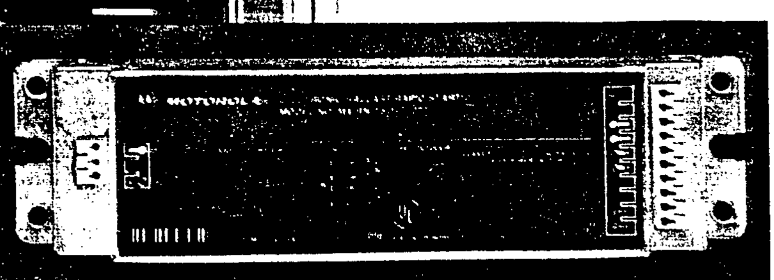
Ballast function

A ballast creates the necessary circuit conditions (voltage, current, wave form) for starting and operating an electric-discharge (fluorescent or high-intensity) lamp. This article addresses fluorescent ballasts.

Fluorescent lamps are filled with a gaseous mixture that includes vaporized mercury. The lamps' inner surfaces are coated with a fluorescent powder. For a lamp to produce light, voltage is supplied to filaments, or cathodes, at each end.

Once the cathodes are heated sufficiently, an arc strikes between them. The electrons and ionized gas inside the tube collide, causing emission of ultraviolet (UV) energy, which reacts with the powder coating and causes it to fluoresce. The UV energy is filtered out by the tube's glass wall,





Among the newest and most rapidly changing products in the lighting industry are electronic high-frequency ballasts. (Photos courtesy of Motorola Lighting, Inc.)

TABLE 1
COMPARING LAMP AND BALLAST COMBINATIONS

Ballast type	Electromagnetic energy saving F40T12 34-watt lamps The standard		Electromagnetic F32T8 lamps	Hybrid F40T12 34-watt lamps		Electronic F40T12 34-watt lamps		Electronic F32T8 lamps	
277 volt	2L/1L	3L	2L/1L	2L/1L	3L	2L/1L	3L	2L/1L	3L
Lamps per ballast	2/1	3	2/1	2/1	3	2/1	3	2/1	3
Ballast per fixture	1/1	1	1/1	1/1	1	1/1	1	1/1	1
ANSI input watts per fixture	113	108 (Note 1)	107	95 (Note 1)	88 (Note 2)	89	89	107 (Note 1)	92
Annual hours of operation (Note 3)	3,120								
Annual kw hours of operation per fixture	353	337	334	296	275	278	278	334	287
Energy cost per kw hour	$0.08								
Annual energy cost per fixture	$28.24	$26.96	$26.72	$23.68	$22.00	$22.24	$22.24	$26.72	$22.96
Annual energy cost from standard		$1.28	$1.52	$4.56	$6.24	$6.00	$6.00	$1.52	$5.28
Ballast factor	0.92	0.94	0.95 (Note 1)	0.80	0.79	0.86	0.86	0.95	0.92
Lumens per watt (Note 5)	68	73	76	71	75	81	81	0.76	86

NOTES:

1) Two manufacturers only
2) One manufacturer only
3) 12 hours/day × 5 days/week × 52 weeks/year = 3,120 hours/year
4) 12 hours/day × 52 weeks/year = 3,120 hours/year
5) 2,800 lumens/lamp × 3 lamps = 8,400 lumens (for F40T12 34-watt 3500K)
   2,850 lumens/lamp × 3 lamps = 8,550 lumens (for F32T8 3500K)

but visible-spectrum wavelengths escape and light is emitted.

One function of the ballast, then, is to take line voltage (120 or 277 volts, alternating current) and supply the proper starting voltage to the cathodes. The ballast also limits current once the arc begins by introducing additional impedance in the circuit. Without added impedance, the lamp would probably not light; if it did, it would quickly self-destruct.

Because fluorescent lamps are particular about starting and operating conditions, and proper performance is dependent upon these electrical characteristics, the American National Standards Institute, Inc. (ANSI) has developed precise ballast performance specifications, ANSI C82.1, C82.2 and C82.3.

The Certified Ballast Manufacturers Association (CBMA) has developed a program that certifies whether a fluorescent ballast meets ANSI C82 series standards, as well as the ANSI 78 series standards for lamps. Certification tests are conducted by ETL Testing Laboratories, Inc., an independent testing agency.

Ballast types

There are three primary types of fluorescent lamp circuits: preheat, rapid start and instant start. Each lamp circuit type has its own ballast.

Preheat—Fluorescent-lamp cathodes must be heated before the arc can be established. This is done by a starter circuit separate from the ballast. The starter switch applies ballast output voltage across the cathodes. When the cathodes are heated, the switch opens. This applies the voltage across the lamp, strikes the arc and initiates the gas discharge.

Rapid start—Rapid-start-lamp cathodes are heated prior to and during operation. The ballast has secondary windings that provide heating voltage across the electrodes. Hybrid ballasts remove this cathode heating circuit once the arc is established.

Instant start—The cathodes of instant-start lamps are preheated prior to applying ballast output voltage. Because the cathodes are unheated, in order to strike an arc, the ballasts must apply voltage to the cathodes that is much higher than that used for rapid-start lamps.

Rapid-start ballasts are the most

While reading guidelines and manufacturer's literature is important, the best teacher is field testing

Law Requires Minimum BEF

Public Law 100-357, also known as the "National Appliance Energy Conservation Amendments of 1988," stipulates a minimum ballast efficacy factor (BEF) for four common fluorescent lamp/ballast combinations (see Table 2). Ballast efficacy factor is defined as the "relative light output divided by the power input of a fluorescent lamp ballast."

The power input of the fluorescent lamp ballast is measured under ANSI C82.2-1984 test conditions. Relative light output is defined as "the light output delivered through the use of a ballast divided by the light output delivered through the use of a reference ballast" and is expressed as a percent. This also is called ballast factor.

Again, test procedures are specified in ANSI C82.2-1984. The standards indicate that ballasts: a) manufactured on or after April 1, 1990, or incorporated into a luminaire by a luminaire manufacturer on or after April 1, 1991; and b) designed to operate at 120 or 277 volts nominal with an input-current frequency of 60 Hz, and in connection with F40T12, F96T12 or F96T120H0 lamps, must be in accordance with the specifications shown in Table 2.

In addition to BEFs, the law stipulates that these ballasts must have a power factor of 0.90 or greater. These standards do not apply, however, to dimming ballasts, ballasts for use in ambient temperatures of 0°F or less, or ballasts designed for residential applications with power factors of less than 0.90. The BEF provides a basis for ballast performance comparison for a specific ballast that eliminates variations in lamps from measurements.

Note, however, BEFs have no relationship to one another when different types or numbers of lamps are involved. Also, BEF information is not always readily available from ballast manufacturers except for the ballasts affected by Public Law 100-357. For this reason, BEF information is of limited use in evaluating efficiency opportunities. □

TABLE 2
MINIMUM BALLAST EFFICACY FACTOR (BEF)

Application for operation of	Ballast input voltage	Total nominal lamp watts	Ballast efficacy factor
One F40T12 lamp	120 277	40 40	1.805 1.805
Two F40T12 lamps	120 277	80 80	1.060 1.050
Two F96T12 lamps	120 277	150 150	0.570 0.570
Two F96T120H0 lamps	120 277	220 220	0.390 0.390

prevalent electromagnetic ballast type. They offer a smoother start than preheat ballasts and generally provide longer lamp life than instant-start ballasts. Electronic ballasts for T8 lamps are often instant start, primarily because energy can be saved by not running a cathode heating circuit.

Lamp life is apparently also a question of hours per burn, especially for T8 lamps. Some lamp manufacturers derate lamp life as much as 5,000 hours for use with instant-start ballasts. But at least one major lamp manufacturer has published information indicating that as hours per burn increase from the standard three hours, lamp life of the F32T8 lamp on an instant-start ballast approaches and finally equals lamp life on a rapid-start ballast.

Energy-efficient ballasts

Both lamps and ballasts have been studied and changed since the oil crisis of the 1970s. A variety of energy-saving lamps are available. Yet without energy-saving ballasts, benefits are limited.

Energy-saving electromagnetic ballasts on the market today use higher-quality components than standard electromagnetic ballasts, thus limiting internal losses, lowering input watts and improving system efficiency. These ballasts operate either standard or energy-saving lamps and, by law, have taken the place of standard ballasts for certain lamps (see "Law Requires Minimum BEF" sidebar).

Further efforts to decrease ballast input watts have produced hybrid ballasts. These devices are for rapid-start lamps, and have the same standard core and coil electromagnetic components as energy-saving ballasts. However, as mentioned previously, they have added electronic components that turn off the cathode heating circuit after the lamps have established the arc, thus saving energy.

Electronic ballasts

Among the newest and most rapidly changing products in the lighting industry are electronic high-frequency ballasts. As early as the 1950s, electronic ballasts were used for specialized needs, but efficien-

To make an informed decision about the best lamp and ballast combination, look at system efficiency and long-term performance

cies were only about 60%, and the ballasts required large heat sinks. It was shown, however, that running fluorescent lamps at high frequencies could improve efficiency, so research continued.

About 10 years ago technology was developed to operate lamps at more than 3,000 Hertz (Hz) through the use of semiconductors. Further research provided circuitry to operate lamps at 20,000 to 30,000 Hz. This technology is being used currently.

Electronic ballasts consist of four basic components: input circuitry, power switch, output circuitry and controller. The input circuit is a rectifier, which converts line voltage alternating current (ac) into direct current (dc). The power switch is an inverter that converts dc into high-frequency ac.

The output circuit uses the high-frequency ac to start the lamp, and the control circuit provides power-factor correction and may incorporate a mechanism for controlling light output.

With an electromagnetic ballast, voltage and current to the lamp cycle 60 times a second. During the course of each cycle, the arc is nearly extinguished 120 times a second, and part of the operating current of the lamp is used to re-energize the phosphors. When current to the lamp is cycling 20,000 times per second or more, the phosphors do not have time to de-energize, so less current is needed to produce an equal amount of light.

Electronic standards

ANSI is in the process of developing a standard for electronic ballasts. A number of manufacturers have established track records for low failure rates and good service. In addition many new companies, or new divisions of old companies, have started making electronic ballasts. Time alone will tell how they will fare, but in the meantime, a specifier must educate himself and his client about the risks and benefits of using this relatively new technology.

Until a broad base of empirical data is developed, consider and weigh as many factors and variables as possible

A good source of general information about electronic ballasts is the California Energy Commission's "Advanced Lighting Technologies Applications Guidelines." Published in March 1990, the section titled "Energy Efficient and Electronic Ballasts" provides application and specification guidelines (see "Electronic Power Community..." sidebar). Ballast manufacturers' technical literature also provides helpful information.

Field testing

The best teacher, however, is field testing. Obviously, not everyone is set up to install test groups of different ballasts and run them in controlled settings to obtain empirical test data. However, if a client has existing facilities and is interested in finding the best system(s), this type of testing should be considered.

If this type of testing is not possible, a company should develop a data base on its projects that use electronic ballasts. Record exactly what systems are installed, including ballast catalog numbers. Note delivery and installation problems (or lack thereof), and keep records of the number of ballast failures in the first six months to three years for each project. There is no substitute for first-hand experience.

Comparing information

In planning a lighting system, it is important to look at more than just watts saved per fixture, especially in new construction. To make an in-

California Energy Commission Sets Forth Ballast Guidelines

The following specifications for electronic ballasts are reprinted, with permission, from the "Advanced Lighting Guidelines" of the California Energy Commission.

2.n. Electronic Ballasts

- UL Listed Class P
- Sound rated A
- No PCBs
- Solid-state electronic ballast consisting of rectifier, high-frequency inverter, and power control and regulation circuitry
- Enclosure size and wiring same as magnetic ballast
- Ballast factor of (see chart or manufacturer's literature) or as required
- Light regulation plus or minus 10% with plus or minus 10% input voltage variation
- High power factor, minimum 90%
- Lamp current crest factor less than or equal to 1.7
- Input current third harmonic not exceeding ANSI recommendation; 32% total harmonic distortion, 27.5% of the third triplens (see manufacturer's literature)
- Flicker 15% or less with any lamp suitable for the ballast
- Lamps shall be operated in (instant start) (rapid start) (rapid start, stepped output) (rapid start, continuously adjustable output) mode
- Design to withstand line transients per IEEE 587, category A
- Ballast case temperature shall not exceed 25°C rise over 40°C ambient
- Shall meet FCC rules and regulations, Part 18
- Describe connection and circuit for adjustable of stepped ballasts
- Three year warranty including $10 labor allowance

Special Note: Specifiers should investigate the marketplace and compare the product offerings closely to the information contained in this guideline. New product developments may make some portions of this report incomplete. □

To order Publication 400-90-014, contact the California Energy Commission at 916/654-5200.

Efforts to decrease input watts have produced hybrid ballasts

Electronic Power Community Concerned With Harmonics

Magnetic and electronic fluorescent ballasts, like computers and motor-speed controls, generate line-current harmonics. With the growing use of these technologies, the electrical power community, including public utilities, are concerned. There are two potential problems.

In three-phase balanced distribution systems, the load can become unbalanced, causing the neutrals to carry additional current and, in some cases, to become overloaded. It also is possible for the harmonics to cause voltage distortion of the supply voltage, which could adversely effect the operation of other electrically sensitive equipment.

In wiring designs where the lighting circuits are isolated by floor from other circuits, these harmonic currents can be controlled and not be allowed to affect the sinusoidal shape of the input voltage.

The range of harmonic currents generated by electronic ballasts can vary from well below 10% to much more than 100% of the fundamental current. In fact, several generate less harmonic current than magnetic ballasts. The majority of producers are holding harmonics to under the proposed ANSI recommended standard of 32% total harmonic distortion and 27.5% of the third triplens (those currents that add upon the three phase neutral). These currents are then easily held to within the IEEE 519 draft standard on voltage distortion for various size building loads.

However, further studies on power quality are in progress, which may alter the harmonic distortion standards. If more stringent measures are necessary, the electronic-ballast industry is prepared to employ additional means to meet the requirements. ☐

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formed decision about the lamp and ballast combination that suits a client's needs, consider system efficiency and long-term performance. Table 1 compares several options in fluorescent lamp and ballast combinations. The comparison is based on using a three-lamp fluorescent fixture.

The first column shows information on "the standard," using 34-watt F40T12 lamps and two standard, electromagnetic, energy-saving ballasts in a two-lamp/one-lamp combination. This is a system typically used in today's offices. The columns that follow provide information on other combinations: 34-watt lamps with a three-lamp ballast; an energy-saving, three-lamp ballast with F32T8 lamps; hybrid ballasts for 34-watt F40T12 lamps in both two-lamp/one-lamp and three-lamp combinations; and 34-watt F40T12 lamps and F32T8 lamps with two-lamp/one-lamp and three-lamp electronic ballasts.

The input wattages shown are, for the most part, averages of published ANSI wattages from three ballast manufacturers. In some cases, a product was available only from one or two of the companies listed; these cases are indicated. Note, in some cases, the manufacturers' published ANSI input wattages deviate by as much as six watts from the averages shown. For ballast factor, some of the published values deviate by as much as 0.04 from the averages shown.

Annual operation hours are based on running fixtures 12 hours per day, five days a week, 52 weeks a year, for a total of 3,120 hours. Energy cost was chosen arbitrarily at $0.08 per kilowatt-hour. Annual energy cost per fixture is the product of input watts, annual operation hours and energy cost. The next row shows the difference in annual energy cost per fixture from the standard. This row is revealing, and if this were the only information given, three-lamp hybrid ballasts would probably be chosen.

However, the next row shows why this may not be the best decision. Ballast factor, also known as relative light output, is the ratio of light output delivered by a ballast to light output delivered by a reference ballast. Note the ballast factor for the three-lamp hybrid ballast is 79%, the lowest of all ballasts compared.

A one-to-one replacement of the standard with this ballast could lower the light level in an existing space significantly, assuming existing fixtures were reasonably clean and had relatively new lamps before the replacement.

Using the three-lamp hybrid ballast in new construction could require 15% more light fixtures to provide the same light output as the standard. Therefore, while $6.24 per fixture in energy costs is saved, light is lost, and worker performance may decrease. Alternatively, additional fixtures may be required, adding cost.

Perhaps the best way to compare fluorescent lamp and ballast combinations is to look at lumens per watt, shown in the last row. In this comparison, the three-lamp electronic ballast with F32T8 lamps does best, at 86 lumens per watt.

The information presented in Table 1 should be used only as a starting point for comparisons. It is important to realize that while ANSI bench test input watts were used for this comparison, input watts for ballasts in fixtures will vary from these values. How much depends on whether the fixture is open or enclosed and the size and location of the ballast compartment, among other variables.

The ANSI input watt values and the ballast factors from up to three manufacturers also were averaged. Compare data from these manufacturers, yet consider other manufacturers as well.

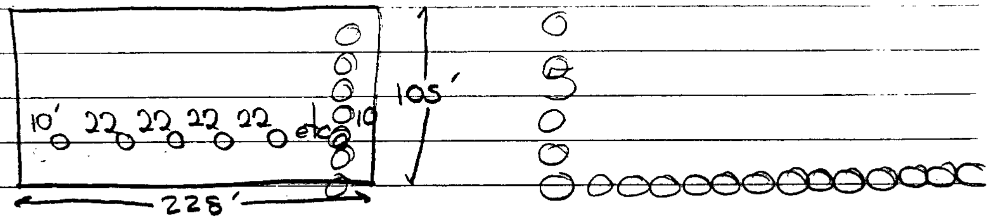
When evaluating ballast and lamp combinations, every project and application is unique. Until a broad base of empirical data is developed, or until the market settles down and offers more standardized products, consider and weigh as many factors and variables as possible. This will ensure the systems you design meet clients' needs for energy conservation and optimum performance over the long term. ☐

Bldg. No.	Existing Fixture Type	# fixtures	Watts/Fixture	Proposed Fixture Type	Watts/Fixture
1743	4' 2-Tube fluoros.	67	96	Replace ballast + lamps	71
	4' 4-Tube fluoros.	3	181	Replace ballast + lamps	140
	8' 2-Tube fluoros	57	172	Replace ballast + lamps	135
	HPS	118	150		
1751	4' 2-Tube fluoros.	187	96	Replace ballast + lamps	71
	4' 4-Tube fluoros.	6	181	Replace ballast + lamps	140
	8' 2-tube fluoros.	3	172	Replace ballast + lamps	135
1753	4' 2-Tube fluoros.		96	Replace ballast + lamps	71
	200W Incand.				
1790	Mercury Vapor				
	Incand.		200		
	4' 4-Tube fluoros.		181	Replace ballast + lamps	140
	4' 2-Tube fluoros		96	Replace ballast + lamps	71

Bldg. No.	Existing Fixture Type	Watts/Fixture	Proposed Fixture Type	Watts/Fixture
1794	Mercury Vapor			
	300W. Inc.	300		
	4' 2-Tube fluoros.	96	Replace ballast & lamps	71
1830	4' 2-Tube fluoros.	96	Replace ballast & lamps	71
	4' 4-Tube fluoros.	181	Replace ballast & lamps	140
1845	Incand.	200		
	4' 2-Tube fluoros.	96	Replace ballast & lamps	71

314

Bldg. 1743 - Replace 118 200-W Incand lamps & fixtures with 55 - 100 WATT metal halide fixtures & lamps



100 W/fixture (124 W Input (w/ballast))
55 fixtures × 124 W = 6,820 W
6,820 W ÷ 120 V = 56.83 Amps

(16 Amps/breaker)(need 4 circuits)

fixtures & lamps (used metal halide - 250 W prices)

MAT	LABOR	O&P	TOTAL
260.00	77.00	63.00	400.00

fixtures & lamps (55 each) - $22,000
4 circuits ≈ 731.80 (+)
Demolition ≈ 1,185.90

23,917.70 AT LEAST

6300 lumens/fixture

EMC ENGINEERS, INC.
PROJ. #______ PROJECT __________
SHEET NO. 4 OF 38


B-17


E-23½


E-17


E-28

Bulb (249)	Ordering Code	Description	ANSI Code Ref. Only	Case Qty	Additional Information See HID footnotes Page 84	MOL In.	LCL In.	Rated Avg. Life Hours (*)	Reference Lumens (Any Burn Pos.) Int. (244)	Mean (205)	Design Factor (210)

HALARC™ LAMPS

This family of high-performance metal halide lamps features higher lumens-per-watt and lumen maintenance, more consistant color, warmer, incandescent-like appearance — and generally provides lower cost-of-light - than other metal halide or mercury lamps of equal wattage. However, a momentary shift of pastel pink color may infrequently occur as this lamp stabilizes during operation.

32 WATTS - HALARC™ LAMP
(Open and Enclosed Fixtures - Base Up ±15° Burning only. Use With GE Approved Ballast
BASE: MEDIUM(NPBB)

E-17	16469	MXR32/C/VBU	M100GZ-32/VBU	6	Coated—Vert ±15°	5 7/16	3½	10000	2500	1900	1.00

100 WATTS - HALARC™ LAMPS
ENCLOSED FIXTURES ONLY - VERTICAL ±15° BURNING ONLY. Use Metal Halide ballast (ANSI spec. "M90")
BASE: MEDIUM (NPBB)

B-17	> 18680	MXR100/BU/BD	M90TW-100/BU-BD	6	Clear—Vert ±15°	5⅜	3⅝	10000	9000	6800	NA
	> 18679	MXR100/C/BU/BD	M90TX-100/BU-BD	6	Coated—Vert ±15°	5⅜	3⅝	10000	8000	6400	NA

175 WATTS - HALARC™ LAMPS
ENCLOSED FIXTURES ONLY - VERTICAL ±15° BURNING ONLY. Use Metal Halide ballast (ANSI spec. "M57")

WARNING:DO NOT USE IN EXPLOSION PROOF OR HAZARDOUS DUTY FIXTURES BECAUSE HALARC LAMPS HAVE HIGHER BULB TEMPERATURES THAN STANDARD 175-WATT METAL HALIDE LAMPS AND MAY EXCEED THE TEMPERATURE RATING OF THESE FIXTURE TYPES.

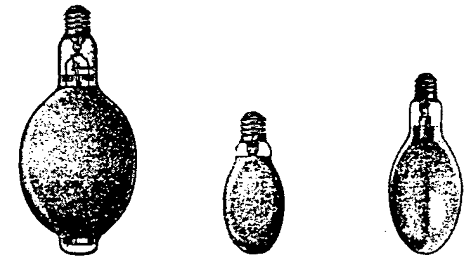
BASE: MOGUL (NPBB)

E-23½	11417	MXR175/BU	M57PE-175/XBU	6	Clear—Vertical ±15°(277)	7½	5	10000	16600	13300	0.90
	11203	MXR175/C/BU	M57PF-175/XBU	6	Coated—Vertical ±15°(277)	7½	5	10000	15750	12150	0.90
	11420	MXR175/BD	M57PE-175/XBD	6	Clear—Vertical ±15°(277)	7½	5	10000	16600	13300	0.90
	11418	MXR175/C/BD	M57PF-175/XBD	6	Coated—Vertical ±15°(277)	7½	5	10000	15750	12150	0.90

STANDARD-LINE MULTI-VAPOR® LAMPS
175 WATTS - MULTI-VAPOR - ENCLOSED FIXTURES ONLY. Use Metal Halide Ballast
(ANSI spec. "M57")
BASE: MOGUL

E-28	47760	MVR175/U	M57PE-175/U	12	Clear (260)	8¼	5	10000V 6000H	14000V 12000H	10350V 8300H	0.70
	47761	MVR175/C/U	M57PF-175/U	12	Coated (260)	8¼	5	10000V 6000H	14000V 12000H	9950V 7800H	0.70
	17634	MVR175/SP30/U	M57PF-175/SP30	12	Coated (260)	8¼	5	10000V 6000H	12000V 10300H	8300V 7,100H	0.85

> New Product Listing.
* See page 73 for definition of "Rated Life".



BT-56 E-28 E-37

MULTI-VAPOR® METAL HALIDE LAMPS

EMC ENGINEERS, INC.
PROJ. #______ PROJECT ______
SHEET NO. 5 OF 38

Bulb (249)	Ordering Code	Description	ANSI Code Ref. Only	Case Qty	Additional Information See HID footnotes Page 84	MOL In.	LCL In.	Rated Avg. Life Hours (*)	Reference Lumens (Any Burn Pos.) Int. (244)	Mean (205)	Design Factor (210)

250 WATTS - MULTI-VAPOR LAMPS - ENCLOSED FIXTURES ONLY. Use Metal Halide Ballast (ANSI spec. "M58")
BASE: MOGUL

Bulb (249)	Ordering Code	Description	ANSI Code Ref. Only	Case Qty	Additional Information	MOL In.	LCL In.	Rated Avg. Life Hours (*)	Int. (244)	Mean (205)	Design Factor (210)
E-28	42729	MVR250/U	M58PG-250/U	12	Clear	8 1/4	5	10000	20500V 19500H	17000V 14000H	0.80
	42731	MVR250/C/U	M58PH-250/U	12	Coated	8 1/4	5	10000	20500V 19500H	16000V 13500H	0.80
	17633	MVR250/SP30/U	M58PH-250/SP30	12	Coated	8 1/4	5	10000	18000V 17600H	14200V 13950H	0.80

400 WATTS - MULTI-VAPOR LAMPS - In burning positions other than vertical base-up or base-down ±15°, use in enclosed fixtures only. Use Metal Halide ballast (ANSI spec. "M59")
BASE: MOGUL

Bulb (249)	Ordering Code	Description	ANSI Code Ref. Only	Case Qty	Additional Information	MOL In.	LCL In.	Rated Avg. Life Hours (*)	Int. (244)	Mean (205)	Design Factor (210)
E-37	43828	MVR400/U	M59PJ-400/U	6	Clear (259)	11 1/2	7	20000V 15000H	36000V 32000H	28800V 23700H	0.75
	43829	MVR400/C/U	M59PK-400/U	6	Coated (259)	11 1/2	7	20000V 15000H	36000V 32000H	27700V 22700H	0.75
	17632	MVR400/SP30/U	M59PK-400/SP30	6	Coated (259)	11 1/2	7	20000V 15000H	33000V 31000H	25000V 23500H	0.80

1000 WATTS - MULTI-VAPOR LAMPS - In burning positions other than vertical base-up or base-down ±15°, use in enclosed fixtures only. Use Metal Halide ballast (ANSI spec. "M47")**
BASE: MOGUL

Bulb (249)	Ordering Code	Description	ANSI Code Ref. Only	Case Qty	Additional Information	MOL In.	LCL In.	Rated Avg. Life Hours (*)	Int. (244)	Mean (205)	Design Factor (210)
BT-56	41826	MVR1000/U	M47PA-1000/U	6	Clear	15 3/8	9 1/2	12000V	110000V 107800H	88000V 86240H	0.80
	41827	MVR1000/C/U	M47PB-1000/U	6	Coated	15 3/8	9 1/2	12000V	105000V 100000H	79800V 76000H	0.80

HIGH-OUTPUT LINE MULTI-VAPOR® LAMPS

400 and 1000-watt lamps providing higher light output than the Standard Line Multi-Vapor lamps, for use where lamp operating position is near-vertical. Also, 1500-watt lamps providing very high light output for sports floodlighting or other uses where their shorter average life is acceptable.

175 WATTS - HIGH OUTPUT LINE - HORIZONTAL ±15° BURNING ONLY. Use Metal Halide Ballast (ANSI spec. "M57") Use in Position Oriented Mogul Sockets.
BASE: MOGUL (NPBB)

Bulb (249)	Ordering Code	Description	ANSI Code Ref. Only	Case Qty	Additional Information	MOL In.	LCL In.	Rated Avg. Life Hours (*)	Int. (244)	Mean (205)	Design Factor (210)
E-28	> 18104	MVR175/HOR	—	12	Clear: HORIZ. ± 15°	8 5/16	5	10000	15000	12000	NA
	> 18105	MVR175/C/HOR	—	12	Coated. HORIZ. ± 15°	8 5/16	5	10000	15000	11300	NA

250 WATTS - HIGH OUTPUT LINE - HORIZONTAL ±15° BURNING ONLY. Use Metal halide ballast (ANSI spec. "M58") Use in Position Oriented Mogul Sockets.
BASE: MOGUL (NPBB)

Bulb (249)	Ordering Code	Description	ANSI Code Ref. Only	Case Qty	Additional Information	MOL In.	LCL In.	Rated Avg. Life Hours (*)	Int. (244)	Mean (205)	Design Factor (210)
E-28	> 18101	MVR250/HOR	—	12	Clear—HORIZ ± 15°	8 1/4	5	10000	23000	18000	—
	> 18103	MVR250/C/HOR	—	12	Coated—HORIZ. ± 15°	8 1/4	5	10000	23000	17000	—

> New Product Listing.
* See page 73 for definition of "Rated Life".
** Can also be used on mercury lag or reactor type ballast with 440-volt minimum open-circuit voltage. This will provide reliable starting above 0°F. Lamps will typically operate at 970 watts. 109,200 lumens and 87,350 mean lumens.

RAPID START BALLASTS

Including Performance™, Optimiser, Maxi-Miser™ II, and Watt-Miser™ Ballasts
For 25-, 28-, 30-, 34-, and 40-Watt Rapid Start Lamps
60 Hertz

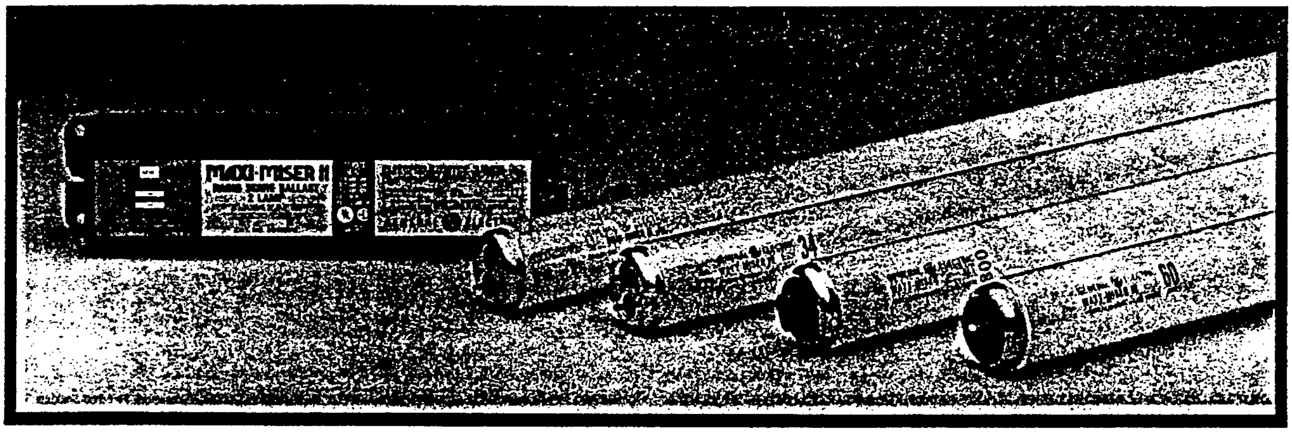
Lamp Description: Number and Type	Lamp Description: Nom. Watts	Input Circuit Voltage	Ballast Description	Catalog① Number	Certification	Min. Start Temp. F°	Line② Current Amps	② Input Watts	Sound Rating	Wiring Diagram Fig. No.	Dimensions (Inches): Length	Height	Width	Ballast Circuit Type
ONE-LAMP LOW POWER FACTOR														
(1) F30T12	30	120	Standard	8G1075③	—	50	0.63	36	A	13	6½	1⅜	1¹⁵⁄₁₆	Lag
(1) F40T12	40	120	Standard	8G1075③	—	50	0.60	36	A	13	6½	1⅜	1¹⁵⁄₁₆	Lag
		120	Dimming	8G3670	—	50	0.53	40	A	15	6½	1⅜	1¹⁵⁄₁₆	Lag
ONE-LAMP HIGH POWER FACTOR														
(1) FM28④	28	120	Optimiser	M28-120-1F	ETL	60	0.39	37	A	42	9½	1½	2⅜	Lead
		277	Optimiser	M28-277-1F	ETL	60	0.17	38	A	42	9½	1½	2⅜	Lead
(1) F30T12/RS	30	120	Standard	8G1071W	CBM	50	0.40	46	A	22	9½	1½	2⅜	Lead
		120	Low Temp.	8G3688W	—	0	0.45	54	A	22	9½	1¹¹⁄₁₆	2⅜	Lead
		240	Standard	8G3930WF	—	50	0.18	42	B	12	9½	1½	2⅜	Lead
		277	Standard	8G1072W	CBM	50	0.17	46	A	22	9½	1½	2⅜	Lead
		277	Low Temp.	8G3689W	—	0	0.20	54	A	22	9½	1¹¹⁄₁₆	2⅜	Lead
(1) F40T12/RS Energy Saving	34	120	Maxi-Miser II	8G1078W③	ETL	60	0.38	45	A	42	9½	1½	2⅜	Lead
		277	Maxi-Miser II	8G1088W③	ETL	60	0.17	47	A	42	9½	1½	2⅜	Lead
		120	Optimiser	M28-120-IF	—	60	0.32	37	A	42	9½	1½	2⅜	Lead
		277	Optimiser	M28-277-IF	—	60	0.15	38	A	42	9½	1½	2⅜	Lead
(1) F40T12/RS	40	120	Standard	8G1063W③	CBM	50	0.48 .90	52	A	42	9½	1½	2⅜	Lead
		120	Watt-Miser	8G1074W③	CBM	50	0.40 1.00	48	A	42	9½	1½	2⅜	Lead
		120	Maxi-Miser II	8G1078W③	—	50	0.44 .985	52	A	42	9½	1½	2⅜	Lead
		120	Low Temp.	8G3688W	—	0	0.45	54	A	22	9½	1¹¹⁄₁₆	2⅜	Lead
		120	Dimming	8G5001WF	—	50	0.43	50	A	15	9½	1¹¹⁄₁₆	2⅜	Lag
		120	Optimiser	M28-120-1F	—	50	0.39	45	A	42	9½	1½	2⅜	Lead
		240	Standard	8G3930W	—	50	0.23 .906	50	B	12	9½	1½	2⅜	Lead
		277	Standard	8G1068W③	CBM	50	0.20 .99	55	A	42	9½	1½	2⅜	Lead
		277	Watt-Miser	8G1084W③	CBM	50	0.18 1.00	50	A	42	9½	1½	2⅜	Lead
		277	Maxi-Miser II	8G1088W③	—	50	0.19 1.02	54	A	42	9½	1½	2⅜	Lead
		277	Low Temp.	8G3689W	—	0	0.20	54	A	22	9½	1¹¹⁄₁₆	2⅜	Lead
		277	Optimiser	M28-277-1F	—	50	0.17	46	A	42	9½	1½	2⅜	Lead
TWO-LAMP HIGH POWER FACTOR														
(2) F30T12/RS Energy Saving	25	120	Optimiser	M28-120	ETL	60	0.41	60	A	14	9½	1½	2⅜	Series Lead
		277	Optimiser	M28-277	ETL	60	0.18	61						
(2) FM28	28	120	Optimiser	M28-120	ETL	60	0.53	60	A	14	9½	1½	2⅜	Series Lead
		277	Optimiser	M28-277	ETL	60	0.23	60	A	14	9½	1½	2⅜	Series Lead
(2) F30T12/RS	30	120	Standard	8G3971W	CBM	50	0.67	78	A	14	9½	1½	2⅜	Series Lead
		120	Low Temp	8G3905W	—	0	0.63	74	A	14	9½	1¹¹⁄₁₆	2⅜	Series Lead
		277	Standard	8G3972W	CBM	50	0.29	78	A	14	9½	1½	2⅜	Series Lead
		277	Low Temp	8G3907W	—	0	0.28	76	A	14	9½	1¹¹⁄₁₆	2⅜	Series Lead
(2) F40T12/RS Energy Saving	34	120	Maxi-Miser II	8G1028W③	ETL	60	0.64	76	A	14	9½	1½	2⅜	Series Lead
		120	Maxi-Miser II Kit	8G1028W10③	ETL	60	0.64	76	A	14	9½	1½	2⅜	Series Lead
		277	Maxi-Miser II	8G1038W③	ETL	60	0.28	77	A	14	9½	1½	2⅜	Series Lead
		120	Optimiser	M28-120	—	60	0.52	59	A	14	9½	1½	2⅜	Series Lead
		277	Optimiser	M28-120	—	60	0.22	60	A	14	9½	1½	2⅜	Series Lead
(2) FE40/WM	34	120	Performance	E40-120-2	—	60	0.54	62	A	14	9½	1½	2⅜	Series Lead
		277	Performance	E40-277-2	—	60	0.22	62	A	14	9½	1½	2⅜	Series Lead
(2) FE40/MM	40	120	Performance	E40-120-2	—	50	0.65	74	A	14	9½	1½	2⅜	Series Lead
		277	Performance	E40-277-2	—	50	0.26	74	A	14	9½	1½	2⅜	Series Lead

① High-power-factor ballasts are suitable but not CBM certified for use with energy-saving lamps. Minimum temperature for energy-saving lamps is 60°F. Energy-saving lamps are not suitable with dimming and 30-watt single-lamp Rapid Start ballasts.

② Input watts per tests to ANSI C82.2. Watts measured in installed fixtures will be lower and vary by application.

③ CSA approved.

ALL FOUR GE MAXI-MISER™ II SYSTEMS USE FEWER WATTS, PROVIDE EFFECTIVE WAY TO REDUCE YOUR COST OF LIGHT



GE technology has created a family of low-loss, energy-saving fluorescent ballasts designed to operate today's high efficiency lamps at peak light output. More light, in fact, than other ballasts commercially available today.

Available in 4′ rapid start to operate Maxi-Miser or Watt-Miser lamps and in 8′ to operate Slimline or High Output Watt-Misers, these Maxi-Miser II systems offer you an effective way to lower your fluorescent cost of light.

Maxi-Miser II Ballasts

- Compatible with straight tube standard or 34-, 35-, 60-, or 90-watt energy-saving lamps.
- Cooler operation extends ballast life.
- Dimensionally interchangeable with standard ballasts.
- Light output and input watts ETL-Certified.
- UL-Listed, Class P.
- Available for 4′ rapid start, 8′ instant start, and 8′ high output lamp applications.

For New Fixtures

Combine the Maxi-Miser II F40 ballast with GE's F40 Maxi-Miser II lamp and maintained light output will be 20% more than standard systems in typical 4-lamp fixtures. Used in an enclosed three-lamp troffer, this Maxi-Miser II system produces 95% of the maintained light of a standard four-lamp fixture.

For Replacement

If you want the most light and good energy savings, Maxi-Miser II Systems are easily installed in existing fixtures. For example, 8′ Slimline Maxi-Miser II ballast and Watt-Miser II lamps reduce watts 21%, with no loss of light compared to a standard F96T12 system.

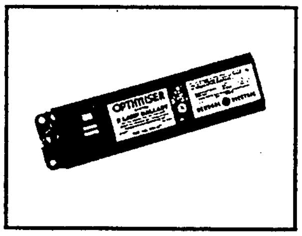
Cost of Light Comparison*: Maxi-Miser II Lamps & Ballasts

Design Criteria 100 FC Maintained 10,000 Square Feet 3,000 Hours/Year 8¢/KWH Energy Rate 2 X 4 Troffers	4 Standard Lamps On Standard Ballasts	4 Maxi-Miser II Lamps On Maxi-Miser II Ballasts	3 Maxi-Miser II Lamps On Maxi-Miser II Ballasts**
• Number of Fixtures	206	171	216
• Relative Costs			
Initial	100%	89%	100%
Operating	100%	84%	80%
• Total Annual Owning and Operating Cost	100%	84%	85%

* For basic lamp and ballast data, and cost assumptions used in this comparison, see the 1984 edition of General Lighting Cost Analysis, publicaiton #205-41211. A copy can be obtained by contacting your GE Lamp & Ballast sales representative.

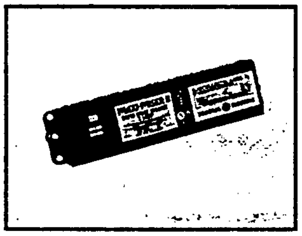
** 2-Lamp Ballasts, Tandem-Wired.

FLUORESCENT BALLAST DESCRIPTIONS



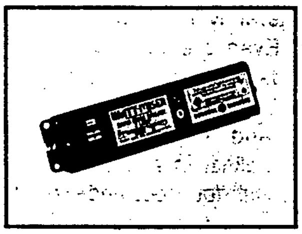
Optimiser

Innovative hybrid energy-saving ballast. Combines long-life solid-state switch with proven electromagnetic components. Use with 28-watt lamps to replace standard F40 systems and reduce lighting energy 34%. See page 5.



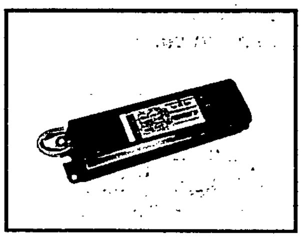
Maxi-Miser™ II

Full light output energy-saving ballast designed to improve lighting system performance. Maximum benefits when used with Maxi-Miser II or Watt-Miser II lamps. See page 6.



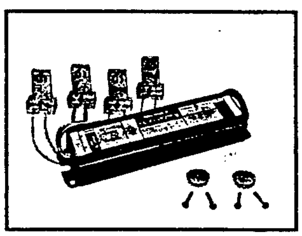
Watt-Miser™

Economical energy-saving ballast. Uses less watts than standard ballasts. Compatible with standard or energy-saving lamps. See page 7.



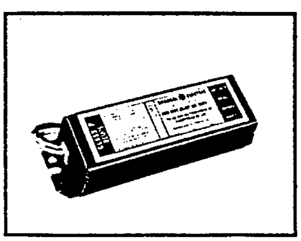
Standard

Standard performance ballasts rated 50°F minimum starting temperature. High power factor. Encased.



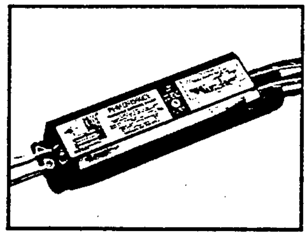
Quick Change Kits

Two-lamp F40 rapid-start ballasts with factory-wired lampholders. Designed to replace preheat or standard rapid-start ballasts in existing fixtures.



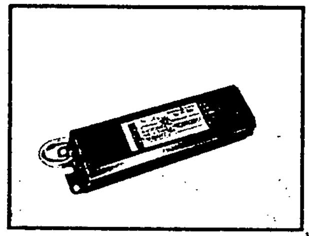
Low Power Factor

Open or encased ballasts without capacitors. Ballasts are usually smaller in size, but use more current than comparable high power factor ballasts.



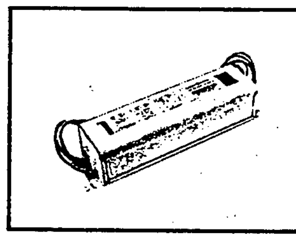
Performance™

Electronic high frequency ballast operates at very high efficiency. Contains advance state-of-the-art circuitry for maximum reliability and efficiency. Available in four models for 120- or 277-volt systems and two- or three-lamp designs. See page 4.



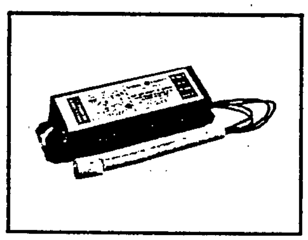
Low Temperature

Standard performance ballasts capable of starting at 0 or −20 F. Suitable for indoor use or mounting in enclosed fixtures. Not weatherproof.



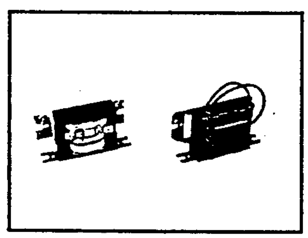
Plastic Sign

Ballast suitable for use in outdoor plastic signs. UL type II. Designed to meet lamp specifications for low-temperature starting. White case. Not weatherproof.



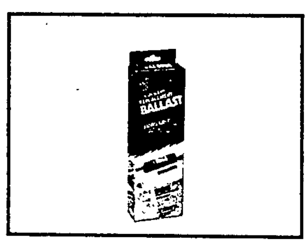
Circline

Encased Circline preheat ballasts are supplied with factory-wired four pin lampholder.



Clamp-Core

Small core-and-coil ballast. Models with leads have metal case over the coil. Appliance models have quick connect terminals. Includes ballasts for Mod-U-Line® Twin Tube lamps.



Consumer Pack

Popular ballasts used by DIY customers. Special packaging includes hook hang carton, wire nuts and installation instructions.

Bldg. 1790
·400 w Mercury Vapor

250w Mercury Vapor - 85 Currently
12,100 Int. lumens each

~~- Replace w/150 w HPS lamps & fixtures at ≈ 15,600 lumens e~~

200w INCAND. - 13 currently -
≈ 3710 App. lumens each

1,028,500 total lumens in 98 fixtures

Replace both w/150w HPS lamps & fixtures at ≈ 15600
lumens ea. for ; total lumens

Current wattage = 21,250 Proposed wattage = 14,700
+ 2,600
23,850 Savings of 9,150 watts

$$\frac{1,029,000 \text{ lumens}}{15,600 \frac{\text{lumens}}{\text{HPS fixture}}} = 66 \text{ FIXTURES.}$$

$66 \times 150W = 9.9\ KW$

Reduction in wattage = 23,850 - 9,900 = 14,050 = 14 KW

$\# Savings = 14\ KW \times 2200 \frac{hrs}{yr} \times \$0.0221 + 14\ KW \times 19.50 \frac{}{mo} \times 12\ mo$

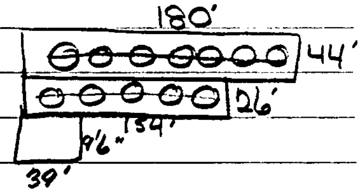
$= \$681 + \$3276 = \$3,957/yr$

Complaints of inadequate lighting

Bldg. 1753 - Replace 26 - 200 W Incand. fixtures with 12, 175 W. Metal Halide fixtures

26 - 200W incandescent lamps @ 3700 lumens each = 96,200 lumens total

Replace with 12 - 175 W Metal Halide fixtures @ ~~20,000~~ 12,000 (75 W) lumens each = 144,000 lumens



lights ≈ 16' High

Materials	Labor	O&P	Total
260.00	77.00	63.00	400.00

Fixtures & lamps (12 each)

3120.00	924.00	756.00	4,800.00

Lighting Branch Circuits:

175 W fixture (217 W input (w/ballast)

12 fixtures × 217W = 2,604 W

2,604 W ÷ 120V = 21.7 Amps

(16 A/Circuit) = 2 Circuits

	Circuit #1	Circuit #2
	+180 FT.	+154 FT.
Base Cost	182.95	182.95
X-tra FT.	597.60	511.28
	780.55	+ 694.23 = $1,474.78

Demolition: $10.05/FIXTURE @ 26 FIXTURES = $261.30

$6536.08

Bldg. 1753

Current energy use - 26,200W Incand fixtures = 5,200 W
Proposed " " - 12,175W Metal halides = ≈ 2,604
(≈ ~~217~~ 205 W ea)
2,596 W

Bldg. 1790 Replace 84, 400-Watt Mercury Vapor lamps with 325-Watt, Metal Halide lamps

	Materials	Labor	O&P	Total
each	71.70	9.31	17.01	98.02
total	$6022.80	782.04	1428.84	8,233.68

Current energy use = 84 × 460 = 38,640 watts
Proposed " " = 84 × 406.25 = 34,125 "

4,515 watts savings

Building 1794

Materials

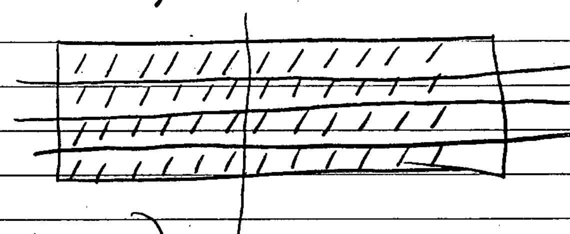
Mat	Labor	O&P	Total
260.00	77.00	63.00	400.00

total materials (48 each)

12,480	3,696	3,024	$19,200

Circuits

290 w/fixture × 48 fixtures = 13,920 W
13,920 ÷ 120V = 116 Amps
(16 Amps/circuit = 8 circuits)



8 Circuits (each +151 ~~feet~~ of wiring)
Base cost = 182.95 + ($3.32 × 151 FT) = $684.27/each
$684.27 × 8 = $5,474.16

Demolition

$100.5/Fixture @ 96 fixtures = $9648.0

Total = $25,638.96

Bldg. 1794 - Replace 48 400 W Mercury Vapor lamps, and 48, 200 W Incandescent lamps with ____ Metal Halide Lamps & Fixtures

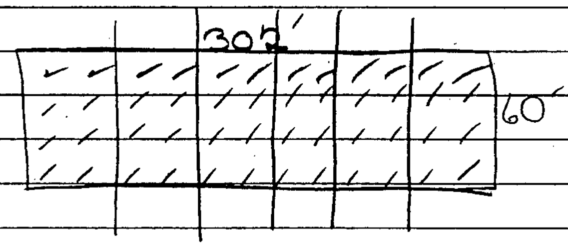
mercury vapor ≈ 43 lumens/watt = 17,200 lumens/lamp
= 17,200 × 48 = 825,600 lumens

200 W Incand ≈ 3700 lumens/lamp =
= 3,700 × 48 = 177,600 lumens

1,003,200 lumens total

250 Watt Metal halides = ≈ 80 lumens/watt = 20,000 lumens/lamp
= 20,000 ×
(1,003,200 ÷ 20,000 = 50 lamps)

lamps ≈ 16' High



Energy Savings:

Current energy use = 400 W Mercury Vapor ≈ 460 watts/each
= 48 × 460 = 22,080 Watts
48 - 200 W Incand = ≈ 200 watts/lamp = 9,600 Watts
22,080
9,600
31,680 watts current

Drawn on 48, 250-W Metal Halides = (290/fixture)
= 290 × 48 = 13,920 Watts

= 17,760 Watt savings

REMOVAL OF 57 EXISTING INCANDESCENT FIXTURES IN BLDG. 236
REPLACE WITH 12, 250 WATT METAL HALIDE FIXTURES AND LAMPS

PRICES PER MEANS 1992 ELECTRICAL COST DATA AND RICHARDSON PROCESS PLANT CONSTRUCTION ESTIMATING STANDARDS

WILL REQUIRE:

- 3 CIRCUITS - NEW CONDUIT & WIRING
- FIXTURES (W/BALLAST) AND LAMPS
- DEMOLITION OF EXISTING EQUIPMENT

FIXTURES & LAMPS (EACH):

MATERIAL	LABOR	O&P 18.7%	TOTAL
$260.00	$77.00	$63.00	$400.00

FIXTURES & LAMPS (12 EACH):

MATERIAL	LABOR	O&P 18.7%	TOTAL
$3,120.00	$924.00	$756.00	$4,800.00

LIGHTING BRANCH CIRCUITS:
BASE COST EQUALS BRANCH CIRCUIT MATERIALS AND LABOR TO 20 FEET ABOVE FLOOR
FOR EACH ADDITIONAL FOOT OF CONDUIT RUN, $3.32 WAS ADDED

	CIRCUIT #1 +120 FT.	CIRCUIT #2 +162 FT.	CIRCUIT #3 +200 FT.	TOTAL
BASE COST:	$182.95	$182.95	$182.95	
	$398.40	$537.84	$664.00	
	$581.35	$720.79	$846.95	$2,149.09

DEMOLITION:

$10.05/FIXTURE @ 57 FIXTURES $572.85

$7,521.94

Energy Savings = Current energy use = 11,400 WATTS
proposed " " = 3,480 "
7920

AGE 2

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BRANCH CIRCUITS FOR LIGHTING - RAPID E

THIS ACCOUNT PRESENTS THE RICHARDSON ... UITS FOR
LIGHTING INSTALLED. WORK PERFORMED B...

LIGHTING BRANCH CIRCUIT

A. Standard Installation. Costs shown are based on installations inside a single story building in a non-hazardous area, not over 12'-0" above floor.

Description	Material Cost	Manhours	Labor Cost @ $25.00/Hour	Total Material & Labor
20 LF 1/2" Galvanized Rigid Conduit	$20.11	(0.8)		
2 Ea. 1/2" Galvanized Elbow W/One Coupling Each	9.00	(0.7)		
65 LF #12 THW Copper Wire	5.32	(0.3)		
2 Ea. 1/2" Pipe Straps	0.20	(0.1)		
1 Ea. 4" Sq. Outlet Box W/Lock Nut & Bushing	3.05	(0.4)		
Blank Cover	0.66	(0.1)		
Total Standard Branch Circuit For Lighting	$38.34	(2.4)	$60.00	$98.34

For each additional foot of Conduit Run, including wire, add $2.84 to Total Cost shown above.

B. Hi-Bay Installation. Costs shown are based on installations inside a single story building in a non-hazardous area not over 20'-0" above floor.

Description	Material Cost	Manhours	Labor Cost @ $25.00/Hour	Total Material & Labor
40 LF 3/4" Galvanized Rigid Conduit	$49.87	(1.6)		
2 Ea. 3/4" Galvanized Elbow W/One Coupling Each	10.92	(0.8)		
130 LF #10 THW Copper Wire	17.38	(0.7)		
6 Ea. 3/4" Pipe Straps	0.70	(0.4)		
1 Ea. 4" Sq. Outlet Box W/Lock Nut & Bushing	3.42	(0.4)		
Blank Cover	0.66	(0.1)		
Total Hi-Bay Branch Circuit For Lighting	$82.95	(4.0)	$100.00	$182.95

For each additional foot of Conduit Run, including wire, add $3.32 to Total Cost shown above.

Notes:

1. The Standard Unit Prices shown in this Account were developed using costs from Accounts 16-1, 16-19 and 16-20 and include all material, layout, measurements for installation, handling the conduit and fittings, cutting and threading the conduit, installing the conduit and fittings, pulling the wires in the conduit, making wiring terminations, testing and checkout.

2. The Lighting Panel Board is not included; add from Account 16-44. The Lighting Fixture is not included; add from Account 16-60.

3. Refer to Account 16-90 for Circuit Feeders.

ALL-PHASE ELECTRIC SUPPLY CO.

QUOTATION Form No. S

Issued to:

Angie
988-2951

Bid Due
Job Name White Sands Gymnasium
Location
Architect
Engineer

Date 1/20/92

Page 1 of 2 Pages

Issued from ALL-PHASE ELECTRIC
City Denver

QUANTITY	TYPE	CATALOG NO. OR DESCRIPTION	LAMPS	VOLTS	FUSED	PRICE	UNIT	EXTENSION	APPROX. DELIVERY
11		711250MAE.MTB Stonco							$123.35ea
11		MVR250U GE							$ 23.00ea

EMC ENGINEERS, INC.
PROJ. # ____ PROJECT ____
SHEET NO. 19 OF 38

THE ABOVE INFORMAL QUOTATION IS SUBJECT TO
ALL-PHASE ELECTRIC SUPPLY COMPANY'S PUBLISHED TERMS OF SALE.

HIS QUOTATION IS SUBJECT TO ALL MANUFACTURER'S PRICE I EASES, TERMS AND CONDITIONS.

Prepared By: Ken ger

JAN-20-'92 15:08 ID:ALL PHASE DENVER CO TEL NO:303-892-7109 #489 P01

Listed for Damp Location

EMC ENGINEERS, INC.
PROJ. #______ PROJECT ______
SHEET NO. 20 OF 38

711 Series High Bay

250 watts to 400 watts
High Pressure Sodium,
Metal Halide

711400LX

PRODUCT SPECIFICATIONS

☐ APPLICATIONS

Indoor area lighting where ceiling mounting heights exceed 15 feet. Typical applications include warehouse facilities, assembly areas, gyms, hangers, transportation garages, loading and staging areas.

☐ CONSTRUCTION

Light-weight, easy to handle ballast housing die-cast aluminum. Unique design permits full flow-through ventilation for maximum cooling of all components. Includes integral roomy splice box with cover.

Heavy-gauge aluminum dust cap (enclosed units). Protects lamp and reflector from dust and grime. Redirects up-light downward.

Clear heat-tempered glass lens (enclosed units), cushioned in double-gasketed extruded aluminum frame. Retained by stainless spring-clamps and safety bead-chain.

Glazed porcelain lamp socket with plated "lamp-grip" screw shell and spring-loaded center contact. Sockets in HPS units are pulse-rated for 4 KV. Enclosed units may be ordered with sockets mounted for extra-wide beam distribution.

☐ OPTICS

Rigid heavy-gauge diffuse anodized aluminum reflector. Stepped parabolic design provides higher utilization of lamp energy with less trapped light. Cover has diffused surface for use with clear lamps. Semi-specular surface for use with coated lamps available (see Options).

- Reflector for open fixtures: Locks on die-cast adjustable aluminum straps.
- Reflector for enclosed fixtures. Gasketed and attached to reflector dust cap.

Die-cast aluminum reflector straps (open units). Slotted with cast-in numbered positions for field-choice of proper reflector position for maximum lighting efficiency. Reflector positioning is permanently labeled to outside of reflector. Refer to Section 11 for photometric data.

☐ BALLAST

Integral constant wattage high power factor autotransformer (CWA) ballast securely clamped in die-cast aluminum housing. Capacitors are nested within integral "outboard" pods. Vented "air-flow" construction isolates heat-sensitive capacitors from heat-generating core. Refer to Section 11 for electrical data.

☐ INSTALLATION

Rugged die-cast plate tapped 3/4" NPS. Accepts 3/4" pipe or 714/715 die-cast hook. Also accepts 725 steel hook. Unit slips onto mounting plate leaving both hands free for wiring. Ample splice chamber permits quick wiring.

☐ LAMP

(Not supplied.) Scientifically positioned for optimum combination of light intensity and beam width. Refer to Section 11 for lamp data.

ORDERING INFORMATION

Open Catalog No.★	Enclosed Catalog No.★	Watts	Lamp	Ref. Size	Reflector Finish	Reflector Position	Spacing/ Mtg. Htg.
HIGH PRESSURE SODIUM							
711150LX	711150LXE①	150	E23½, BT25, clear	16"	Diffuse	1, 3	1.5, 1.9
■711250LX	711250LXE①	250	E18, clear	17"	Diffuse	1, 2, 3	2.0, 1.5, 1.1
■711400LX	711400LXE①	400	E18, clear	17"	Diffuse	1, 2, 3	1.9, 1.5, 1.0
METAL HALIDE							
—	711175MAE①	175	E28, BT28, clear	16"	Diffuse	1, 3	1.5, 1.9
—	711250MAE①	250	E28, BT28, clear	16"	Diffuse	1, 3	1.5, 1.9
■711400MA	711400MAE①	400	E37, BT37, E18, clear	17"	Diffuse	3, 5, 8	1.8, 1.6, 1.0

★Standard H.I.D. units with constant wattage high power-factor autotransformer are available for 120V, 208V, 240V, 277V, and 480V. To specify, add desired voltage to Cat. No., e.g. 711400LX240V. For Multi-Tap ballasts suitable for field-selection of 120V, 208V, 244V or 277V, add suffix "-MTB".
①Photometric distribution for enclosed units corresponds to position 3 or 4.

OPTIONS

To order the following factory installed options, add appropriate suffix to Cat. No.

Suffix

FACTORY WIRING: 3-foot 3-conductor approved cable (14-3) and heavy-duty 20 amp twist-plug with proper NEMA configuration for specified voltage. Open-loop hook included .... -3CP

FUSING: Heavy-duty fuses in external holder for easy, accessible service.
For 120V and 277V. Single fusing ...... -FS
For 208V, 240V and 480V.
Double fusing .... -FSS

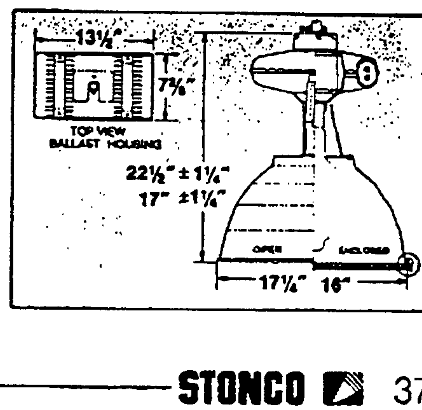
SWITCH-ON AUXILIARY LIGHT: Operates manually from secondary 120V source when HID circuit is "knocked out" by momentary voltage drop. Uses fully adjustable aluminum holder for PAR38 lamp to 150W. Fully adjustable for accurate aiming in critical areas .... -EM

HOT AND COLD START: Auxiliary light is switched on during both cold and hot start conditions and remains on until HID lamp has reached 70% of its designed brightness .... -AMC

SEMI-SPECULAR REFLECTOR: For use with coated lamp.................... -SP

ACCESSORIES

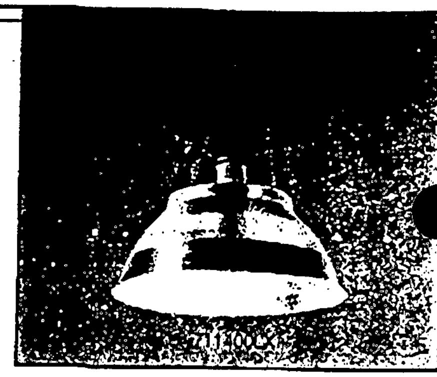
For a complete listing of Accessories—See page 41, 42.



■Stock Item: Normally carried in factory stock and/or at local regional warehouses.

[illegible] ENGINEERS, INC.
~~PROJ. #~~ ~~PROJECT~~
SHEET NO. 21 OF 38

Listed for Damp Location



711 Series High Bay

250 watts to 400 watts
High Pressure Sodium,
Metal Halide

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Heavy-gauge aluminum dust cap (enclosed units). Protects lamp and reflector from dust and grime. Redirects up-light downward.
Clear heat-tempered glass lens (enclosed units), cushioned in double-gasketed extruded aluminum frame. Retained by stainless spring-clamps and safety bead-chain.
Glazed porcelain lamp socket with plated "lamp-grip" screw shell and spring-loaded center contact. Sockets in HPS units are pulse-rated for 4 KV. Enclosed units may be ordered with sockets mounted for extra-wide beam distribution.

☐ OPTICS
Rigid heavy-gauge diffuse anodized aluminum reflector. Stepped parabolic design provides higher utilization of lamp energy with less trapped light. Cover has diffused surface for use with clear lamps. Semi-specular surface for use with coated lamps available (see Options).
• Reflector for open fixtures: Locks on die-cast adjustable aluminum straps.
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711150LX	711150LXE①	150	[illegible] BT25 [illegible]	16	Diffuse	[illegible]	[illegible]
■711250LX	711250LXE①	250	[illegible]	[illegible]	Diffuse	[illegible]	[illegible]
■711400LX	711400LXE①	400	[illegible]	[illegible]	Diffuse	[illegible]	[illegible]
METAL HALIDE							
	711175MAE①	175	[illegible]	16	Diffuse	[illegible]	[illegible]
	711250MAE①	250	[illegible]	16	Diffuse	[illegible]	[illegible]
■711400MA	711400MAE①	400	[illegible] E18 [illegible]	[illegible]	Diffuse	[illegible]	[illegible]

★Standard H.I.D. units with constant wattage high power-factor autotransformer are available for 120V, 208V, 240V, 277V, and 480V. To specify, add desired voltage to Cat. No., e.g. 711400LX240V. For Multi-Tap ballasts suitable for field-selection of 120V, 208V, 244V or 277V, add suffix "-MTB".
①Photometric distribution for enclosed units corresponds to position 3 or 4.

OPTIONS
To order the following factory installed options, add appropriate suffix to Cat. No.

Suffix

FACTORY WIRING: 3-foot 3-conductor approved cable (14-3) and heavy-duty 20 amp twist-plug with proper NEMA configuration for specified voltage. Open-loop hook included .... **-3CP**

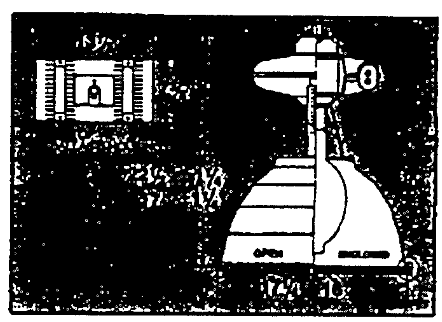
FUSING: Heavy-duty fuses in external holder for easy, accessible service.
For 120V and 277V. Single fusing ...... **-FS**
For 208V, 240V and 480V.
Double fusing .... **-FSS**

SWITCH-ON AUXILIARY LIGHT: Operates manually from secondary 120V source when HID circuit is "knocked out" by momentary voltage drop. Uses fully adjustable aluminum holder for PAR38 lamp to 150W. Fully adjustable for accurate aiming in critical areas .... **-EM**

HOT AND COLD START: Auxiliary light is switched on during both cold and hot start conditions and remains on until HID lamp has reached 70% of its designed brightness .... **-AMC**

SEMI-SPECULAR REFLECTOR: For use with coated lamp .... **-SP**

ACCESSORIES
For a complete listing of Accessories—See page 41, 42.



■ Stock Item: Normally carried in factory stock and/or at local regional warehouses.

For photometric, lamp and electrical data, refer to Section 11.

Steve Prawdzik 573-0222
eef

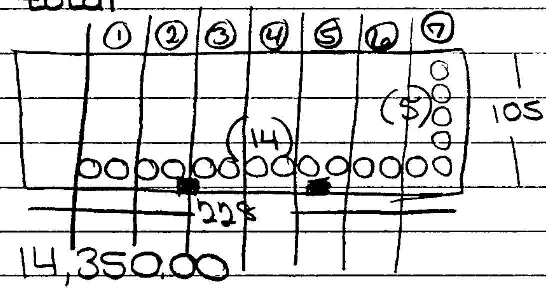
Bldg. 1743 - Replace 118 200W, incandescent lamps & fixtures with 70 8'-2-tube fluorescent fixtures

118 - 200 W incandescent lamps @ 3700 lumens each = 436,600 lumens total

total watts = 23,600

Replace with 70 8' 2-tube fluorescent fixtures @ 6300 lumens eac = 441,000 lumens total

~~96 watts/each lamp~~
~~75 watts/ballast~~
~~267 watts/fixture~~



23,940*

fixtures: 70 ea @ $205 = 14,350.00

Lighting branch circuits:
167* w/fixture
70 fixtures × 167. = 11,690 W
11,690 w/120V = 97.417A
16 Amps/circuit = 7 circuits

Circuit

1	2	3	4	5	6	7	
210'	210'	210'	210'	210'	210'	210'	Add'l feet
182.95	182.95	182.95	182.95	182.95	182.95	182.95	Base Cost
697.20	697.20	697.2	→				Add'l feet $
880.15	→						

= 6,161.05 TOTAL

Demolition $10.05/fixture × 118 fixtures = 1,185.90

Total changeout cost = $21,696.95

* Per Steve Prawdzik @ M/H Lighting Assoc. = 175 W if std. ballast
167 W if energy saving ballast

Building 1743 - Lighting ECO

Fixtures

4'-2-Tube	8' 2-Tube	4' 4-Tube	150 W	~~75 W~~	~~60 W~~
67	57	3	118 (HPS)	~~8~~	~~2~~

~~100 W~~
~~1~~

4' 2-Tube

Current - [67 fixtures × 96 W/fixture] × 2210 HRS/YR = 14,214,720

Proposed - [67 fixtures × 71 W/fixture] × 2210 HRS/YR = 10,512,970

4' 4-Tube

Current - [3 fixtures × 181 W/fixture] × 2210 HRS/YR = 1,200,030

Proposed - [3 fixtures × 140 W/fixture] × 2210 HRS/YR = 928,200

8' 2-Tube

Current - [57 fixtures × 172 W/fixture] × 2210 HRS/YR = 21,666,840

Proposed - [57 fixtures × 135 W/fixture] × 2210 HRS/YR = 17,005,950

150W HPS

Wattage Reduction = Proposed 11,690 Current 23,600 Reduction = 11,910 kW

BRANCH CIRCUITS FOR LIGHTING - RAPID ESTIMATING SYSTEM

THIS ACCOUNT PRESENTS THE RICHARDSON RAPID SYSTEM FOR ESTIMATING BRANCH CIRCUITS FOR LIGHTING INSTALLED. WORK PERFORMED BY AN ELECTRICAL CONTRACTOR.

LIGHTING BRANCH CIRCUIT

A. Standard Installation. Costs shown are based on installations inside a single story building in a non-hazardous area, not over 12'-0" above floor.

Description	Material Cost	Manhours	Labor Cost @ $25.00/Hour	Total Material & Labor
20 LF 1/2" Galvanized Rigid Conduit	$20.11	(0.8)		
2 Ea. 1/2" Galvanized Elbow W/One Coupling Each	9.00	(0.7)		
65 LF #12 THW Copper Wire	5.32	(0.3)		
2 Ea. 1/2" Pipe Straps	0.20	(0.1)		
1 Ea. 4" Sq. Outlet Box W/Lock Nut & Bushing	3.05	(0.4)		
Blank Cover	0.66	(0.1)		
Total Standard Branch Circuit For Lighting	$38.34	(2.4)	$60.00	$98.34

For each additional foot of Conduit Run, including wire, add $2.84 to Total Cost shown above.

B. Hi-Bay Installation. Costs shown are based on installations inside a single story building in a non-hazardous area not over 20'-0" above floor.

Description	Material Cost	Manhours	Labor Cost @ $25.00/Hour	Total Material & Labor
40 LF 3/4" Galvanized Rigid Conduit	$49.87	(1.6)		
2 Ea. 3/4" Galvanized Elbow W/One Coupling Each	10.92	(0.8)		
130 LF #10 THW Copper Wire	17.38	(0.7)		
6 Ea. 3/4" Pipe Straps	0.70	(0.4)		
1 Ea. 4" Sq. Outlet Box W/Lock Nut & Bushing	3.42	(0.4)		
Blank Cover	0.66	(0.1)		
Total Hi-Bay Branch Circuit For Lighting	$82.95	(4.0)	$100.00	$182.95

For each additional foot of Conduit Run, including wire, add $3.32 to Total Cost shown above.

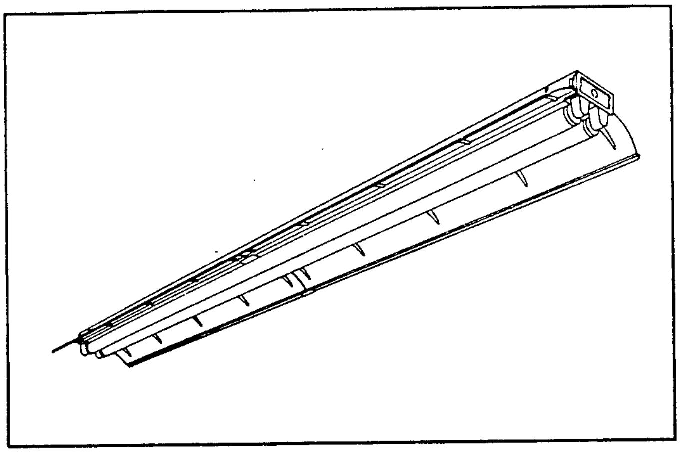
Notes:

1. The Standard Unit Prices shown in this Account were developed using costs from Accounts 16-1, 16-19 and 16-20 and include all material, layout, measurements for installation, handling the conduit and fittings, cutting and threading the conduit, installing the conduit and fittings, pulling the wires in the conduit, making wiring terminations, testing and checkout.
2. The Lighting Panel Board is not included; add from Account 16-44. The Lighting Fixture is not included; add from Account 16-60.
3. Refer to Account 16-90 for Circuit Feeders.

EMC ENGINEERS, INC.
PROJ. #_____ PROJECT __________
SHEET NO. 26 OF 38

CSR296

CSR INDUSTRIAL
TWO LAMP SLIMLINE



TYPE ______________________

JOB INFORMATION ______________________

____

FEATURES:
- Solid reflectors with optional uplight.
- Telescopic spring loaded lampholders.
- 2½" lamp spacing.
- For individual or continuous row mounting.
- Channel ends double as joiners.
- Reflector aligners supplied on 8' fixtures.

SPECIFICATIONS:

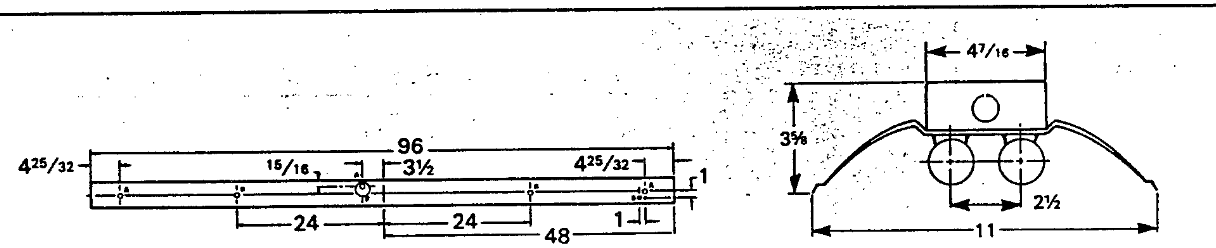
BALLASTS
75 watt Slimline, thermally protected, automatic resetting, Class P, high power factor, CBM, unless otherwise specified.

HOUSING
Die formed steel with knockouts for stems or chain hangers.

REFLECTOR
Die embossed with transverse ribs for maximum rigidity. Available wtih apertures for uplight.

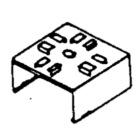
FINISH
All parts pre-painted with high gloss baked white enamel, minimum reflectance 86%, applied over iron phosphate pre-treatment for maximum adhesion and rust resistance.

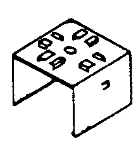
LABELS
All fixtures carry the U.L. label.



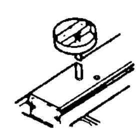
A - 7/8" Diameter Knockout
B - .570 x .656 Strain Relief Knockout
F - 2" Diameter Knockout
R - 11/16" Diameter Knockout
NOTE 1: All Non-Shielded (strip) fixtures—Deduct 1/16" from overall dimension for continuous row mounting. Dimensions shown include end panel.
NOTE: All dimensions are in inches; dimensions are subject to change without notice. Please consult factory or check sample for verification.

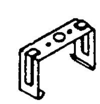
Recommended Hanging Accessories

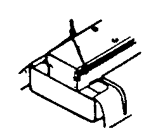

ZT-60F
Zip Tee Hanger


ZT-60
Zip-Tee Hanger


CS-2
Ceiling Spacer


S-18 Stem
and Canopy Set


CL-60
Slide Clamp
Hanger


HC-3
Chain Set

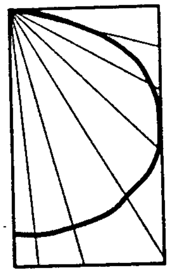
CSR296 TWO LAMP SLIMLINE

CSR INDUSTRIAL

Photometric Data

COEFFICIENTS OF UTILIZATION

RC	80		50	
RW	50	30	50	30
0	102	102	96	96
1	89	85	83	81
2	77	71	73	68
3	68	61	64	58
4	60	52	56	50
5	52	44	49	43
6	46	38	44	37
7	42	34	39	33
8	37	29	35	29
9	33	26	32	25
10	30	23	29	22



CANDLEPOWER

DEG	PARL	NORM
0	3056.	3056.
5	3077.	3043.
10	3030.	3070.
15	2966.	3070.
20	2875.	3053.
25	2763.	3020.
30	2621.	2983.
35	2456.	2918.
40	2274.	2844.
45	2072.	2729.
50	1852.	2584.
55	1616.	2375.
60	1383.	2163.
65	1110.	1920.
70	840.	1535.
75	567.	1098.
80	307.	660.
85	100.	262.
90	8.	1.

ZONAL LUMEN SUMMARY

ZONE	LUMENS	LAMP	FIXT.
0- 30	2480.	19.7	22.9
0- 40	4175.	33.1	38.5
0- 60	7910.	62.8	72.9
0- 90	10848.	86.1	100.0
90-180	0.	0.0	0.0
0-180	10848.	86.1	100.0

RF-20

Ballast Factor: .95, Lamps Rated at 6300 Lumens each
S/MH: PARL 1.27 NORM 1.46

For complete photometric report contact factory.

Ordering Information

Example Complete Catalog Ordering Number: CSR 2 96 A 120 LE EL FF4

CSR 2 96 ___ ___ ___ ___ ___

SERIES

No. OF LAMPS

LAMP WATTAGE

A = APERTURED REFLECTOR FOR UPLITE

VOLTAGE
120 or 277V

INDUSTRIAL OPTIONS

- **LE** Energy Saving Ballast
- **EL** Emergency Battery Pack
- **FF4** Fast Blow Fuse
- **GN** Plug-on Wiring System - see options section for details

INDUSTRIAL ACCESSORIES

ORDER SEPARATELY

- **ZT60F** Zip Tee Hanger - flush mount on tee bar ceiling
- **ZT60** Zip Tee Hanger - 1½" spacer on tee bar ceiling
- **CL60** Slide Clamp Hanger
- **S-18** 18" Stem, canopy and 8° aligner
- **ITB4** Close mounting on Tee Bar ceiling
- **HC3** 14" Chain Hangers

For complete list of options and accessories, see options and accessories section.

Fixture Schedule

Type	Catalog Number

Approvals

Building 1751 - Lighting ECO

4' 2-Tube	4' 4-Tube	8' 2-Tube	60W Inc	100W Inc
187	6	3	~~2~~ 0	~~9~~ 0

4' 2-Tube

Current - [187 fixtures × 96 W/fixture] × 2210 $\frac{HRS}{YR}$ = 39,673,920

Proposed - [187 fixtures × 71 W/fixture] × 2210 $\frac{HRS}{YR}$ = 29,342,170

4' 4-Tube

Current - [6 fixtures × 181 W/fixture] × 2210 $\frac{HRS}{YR}$ = 2,400,060

Proposed - [6 " × 140 W/fixture] × 2210 $\frac{HRS}{YR}$ = 1,856,400

8' 2-Tube

Current - [3 fixtures × 172 W/fixture] × 2210 $\frac{HRS}{YR}$ = 1,140,360

Proposed - [3 fixtures × 135 W/fixture] × 2210 $\frac{HRS}{YR}$ = 895,050

Building 1753 - Lighting ECO

4' 2-Tube	4' 4-Tube	200W Inc	150W Inc	75W Inc	8' 2-Tube
33	4 (OFF)	26 (BAY)	2	4	2 (OFF)

4' 2-Tube

Current - [33 fixtures × 96 W/fixture] × 2210 HRS/YR = 7,001,280

Proposed - [33 fixtures × 71 W/fixture] × 2210 HRS/YR = 5,178,030

200 W. Inc

Building 1790 - Lighting ECO

Mercury Vapor	2000W Inc.	4'4-Tube	4'2-Tube
85 (BAY)	13 (BAY)	6	8

4'4-Tube

Current - [6 fixtures × 181 W/fixture] × 2210 $\frac{HRS}{YR}$ = 2,400,060

Proposed - [6 fixtures × 140 W/fixture] × 2210 $\frac{HRS}{YR}$ = 1,856,400

4'2-Tube

Current - [8 fixtures × 96 W/fixture] × 2210 $\frac{HRS}{YR}$ = 1,697,280

Proposed - [8 fixtures × 71 W/fixture] × 2210 $\frac{HRS}{YR}$ = 1,255,280

Mercury Vapor

2000W Inc.

Bldg. 1790 - 15' High

- 84 Mercury Vapor - (300 W 43 lumens/watt
Multi Vapor - (Metal Halide) (250) or 175 80 lumens/watt
HPS - 112 " "

Metal Halides

load/fixture 250 = 290 w/fixture
25% 175 = 205 w/fixture
175 - 220

Mercury Vapor - 400 Watt (if 400 - use GE I-Line for use as direct Replacement -
$71.76 ↔ Coated
Clear -

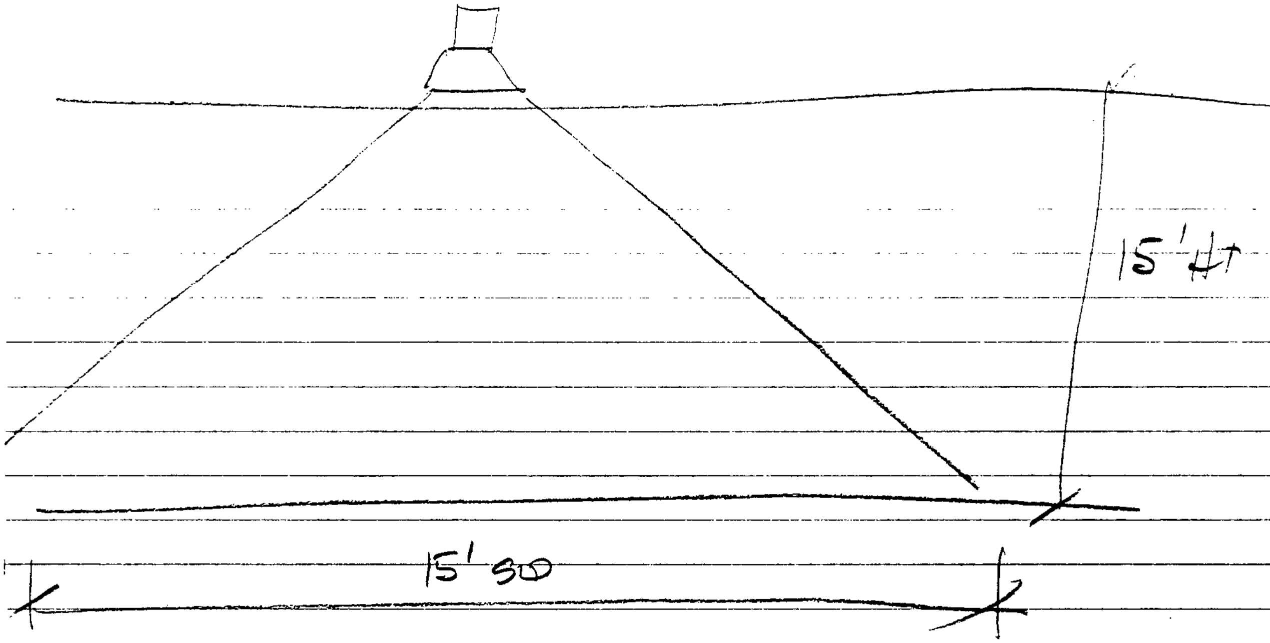
325 W metal halide

Ballast Recommendation list

325 W -

Work w/ Any other wattage lamps?

C-200
$8.00



225 SF/FIXTURE

→ 400W Mercury ≃ 20,000 lumens.

$$\frac{20{,}000 \text{ lumens} \times \underset{(LLF)}{0.80} \times \underset{(CU)}{0.70}}{15 \times 15} = \text{Footcandles } 50FC.$$

Ex: Metal Halide

$$\frac{50FC \times 225 SF}{0.85 \quad 0.70} = 18{,}900 \text{ lumens}$$

250W MH ⇒ 18000 – 20,000
Coated

400W mercury total load 460? Watts

Draw on incandescents
Draw on fluorescents — different wattages
Draw on Metal Halides

175 W Metal Halide = 205 W/fixture

250 W Metal Halide = ~~310~~ 290 watts/fixture

retrofitting

400 W Mercury Vapor = ≈ 460 watts total

Building 1794 - Lighting ECO

Mercury Vapor	300W Inc.	4' 2-Tube
48 (BAY)	48 (BAY)	6

Mercury Vapor

Current: [48 fixtures × 400 W/fixture] × 2210 HRS/YR =

Proposed: (High pressure sodium)

[48 fixtures × 250 W/fixture] × 2210 HRS/YR =

300W. Inc.

4' 2-Tube

Current - [6 fixtures × 96 W/fixture] × 2210 HRS/YR = 1,272,960

Proposed - [6 fixtures × 71 W/fixture] × 2210 HRS/YR = 941,460

Building 1830 - Lighting ECO

4' 2-Tube	4' 4-Tube	150 W Inc	60 W Inc.	75 W Inc	100 W Inc
157	52	~~2~~ 0	~~1~~ 0	~~1~~ 0	~~1~~ 0

4' 2-Tube

Current - [157 fixtures × 96 w/fixture] × 2210 $\frac{\text{Hrs}}{\text{yr}}$ = 33,309,120

Proposed - [157 fixtures × 71 w/fixture] × 2210 $\frac{\text{Hrs}}{\text{yr}}$ = 24,634,870

4' 4-Tube

Current - [52 fixtures × 181 w/fixture] × 2210 $\frac{\text{Hrs}}{\text{yr}}$ = 20,800,520

Proposed - [52 fixtures × 140 w/fixture] × 2210 $\frac{\text{Hrs}}{\text{yr}}$ = 16,088,800

Building 1845 - Lighting ECO

200W Inc	4' 2-Tube
76	6

(explosion-proof fixtures)
(says he never uses these lights)

200W Inc.

4' 2-Tube

Current - [6 fixtures × 96 W/fixture] × 2210 $\frac{HRS}{YR}$ = 1,272,960
Proposed - [6 fixtures × 71 W/fixture] × 2210 $\frac{HRS}{YR}$ = 941,460

JOB 1110.000 WSMR ESCS
CALCULATED BY: HMS DATE: 3-17-92
CHECKED BY: ______ DATE: ______

LIGHTING
ENERGY SAVINGS CALCULATIONS

BLDG.	# HRS/YR	EXISTING # FIXTURES	EXISTING TYPE	EXISTING FIXTURE (KW)	EXISTING TOTAL (KW)	EXISTING KWH/YR	PROPOSED # FIXTURES	PROPOSED TYPE	PROPOSED FIXTURE (KW)	PROPOSED TOTAL (KW)	PROPOSED KWH/YR	DEMAND REDUCTION (KW)	ENERGY SAVINGS (KWH)	ANNUAL ELECTRICAL COST SAVINGS	CONSTRUCTION COST ESTIMATE	SIMPLE PAYBACK
1743	2210	67	FL	0.096	6.432	14214.7	67	FL	0.071	4.757	10512.9	1.675	3701.8	$473.76		
	2210	57	FL	0.172	9.804	21666.8	57	FL	0.135	7.695	17005.9	2.109	4660.9	$596.51		
	2210	3	FL	0.181	0.543	1200.0	3	FL	0.140	0.420	928.2	0.123	271.8	$34.79		
	2210	118	IN	0.200	23.600	52156.0	70	FL	0.167	11.690	25834.9	11.910	26321.1	$3,368.64		
						89237.6					54282.0	15.817	34955.6	$4,473.70	$30,518.72	6.82
1751	2210	187	FL	0.096	17.952	39673.9	187	FL	0.071	13.277	29342.1	4.675	10331.8	$1,322.28		
	2210	6	FL	0.181	1.086	2400.1	6	FL	0.140	0.840	1856.4	0.246	543.7	$69.58		
	2210	3	FL	0.172	0.516	1140.4	3	FL	0.135	0.405	895.05	0.111	245.3	$31.40		
						43214.3					32093.6	5.032	11120.7	$1,423.26	$11,869.65	8.34
1753	2210	33	FL	0.096	3.168	7001.3	33	FL	0.071	2.343	5178.03	0.825	1823.3	$233.34		
	2210	26	IN	0.200	5.200	11492.0	12	MH	0.205	2.460	5436.6	2.740	6055.4	$774.98		
						18493.28					10614.6	3.565	7878.7	$1,008.33	$8,464.65	8.39
1790	2210	84	MV	0.460	38.640	85394.4	84	MH	0.406	34.125	75416.2	4.515	9978.1	$1,277.03		
	2210	13	IN	0.200	2.600	5746.0	0		0.000	0.000	0	2.600	5746.0	$735.39		
	2210	6	FL	0.181	1.086	2400.1	6	FL	0.140	0.840	1856.4	0.246	543.7	$69.58		
	2210	8	FL	0.096	0.768	1697.3	8	FL	0.071	0.568	1255.28	0.200	442.0	$56.57		
						95237.7					78527.9	7.561	16709.8	$2,138.56	$10,167.81	4.75
1794	2210	48	MV	0.460	22.080	48796.8	48	MH	0.290	13.920	30763.2	8.160	18033.6	$2,307.98		
	2210	48	IN	0.200	9.600	21216.0	0		0.000	0.000	0.0	9.600	21216.0	$2,715.27		
	2210	6	FL	0.096	0.576	1273.0	6	FL	0.071	0.426	941.5	0.150	331.5	$42.43		
						71285.8					31704.7	17.910	39581.1	$5,065.68	$25,989.61	5.13
1830	2210	157	FL	0.096	15.072	33309.1	157	FL	0.071	11.147	24634.9	3.925	8674.3	$1,110.15		
	2210	52	FL	0.181	9.412	20800.5	52	FL	0.140	7.280	16088.8	2.132	4711.7	$603.02		
						54109.6					40723.7	6.057	13386.0	$1,713.17	$15,253.27	8.90
1845		76	IN	EXPLOSION-PROOF FIXTURES - NOT ANALYZING												
	2210	6	FL	0.096	0.576	1273.0	6	FL	0.071	0.426	941.5	0.150	331.5	$42.43		
						1273.0					941.5	0.150	331.5	$42.43	$350.65	8.26
236	4368	57	IN	0.200	11.400	49795.2	12	MH	0.290	3.480	15200.6	7.920	34594.6	$2,617.82		
						49795.2					15200.6	7.920	34594.6	$2,617.82	$7,521.93	2.87

KEY:

FL = FLUORESCENT
IN = INCANDESCENT
MV = MERCURY VAPOR
MH = METAL HALIDE

These problems are compounded in still another way. Daytime staff may assume around-the-clock controls are in place. Or, they may never have been informed as to the purpose of a certain switch or lever. In some instances, operating personnel may be inclined to espouse adherence to standards and conditions they "ought" to follow, rather than own up to actual conditions. As a result, those who have done "midnight raids" on facilities frequently report that systems are not running as described.

Equipment age, inadequate or inappropriate maintenance and repairs all contribute to operations that stray from design specs. These problems are compounded by changing contaminant loads and equipment loads; so, even if equipment were operating at design once upon a time, chances are the current needs are no longer served.

These fallacies only begin to reveal how many maintenance problems are rooted in misunderstandings, misconceptions, and the lack of the "right" information. All of which points to the vital role training holds in maintaining a staff qualified to do the job.

Bulwer Lytton once observed "The pen is mightier than the sword." When it comes to achieving a productive cost-effective environment, this sage comment might be paraphrased, "The pen is mightier than the screwdriver." To put it another way, a well-trained O&M staff is widely regarded as the most effective "tool" in implementing an IAQ program.

These two activities—O&M staff training, and a solid PM program for this staff to implement—are imperative if an indoor air quality effort is to succeed.

D5-59

About the Author

Dr. Shirley Hansen is a leading authority in the field of energy management in nonprofit institutions. Her experience is backed by more than twenty years as a manager, educator, author and lecturer. Prior to founding Hansen Associates in 1980, Dr. Hansen was the Director of the Schools and Hospitals Conservation Division of the U.S. Department of Energy. Her interest in maintaining comfortable, healthy and energy efficient buildings led her into the indoor air quality field. She has presented papers at national and international conferences on optimizing indoor air quality and energy efficiency and on preventive strategies to maintain quality indoor air.

Dr. Hansen's new book, *Managing Indoor Air Quality*, will be released in the fall of 1990. 6" x 9", hardcover, $62.00, The Fairmont Press, 700 Indian Trail, Lilburn, GA 30247.

AN ENERGY/ECONOMIC ANALYSIS

Performance of Retrofit Optical Reflectors

JEFFREY KESSEL, P.E., *Associate Engineer*
Energy Conservation Office
University of California at Berkeley

PRIOR TO AWARDING A MAJOR CONTRACT TO INSTALL RETROFIT OPTICAL reflectors at the University of California at Berkeley, the Department of Facilities Management made a detailed study of the performance of the candidate reflectors. The results were used to predict life-cycle cost of these reflectors when used with commercially available partial light-output ballasts.

Performance-based credits were given to the bids of the better-performing reflectors.

Key findings of the research are as follows:

1. **If a mirror-like reflector is installed in a luminaire in conjunction with removing half its lamp complement, then the resulting lights levels (footcandles) were found to be 59 percent to 73 percent of the original, depending on design and material of the reflector. Note that the higher value is almost equivalent to getting three lamps worth of light from two lamps.**
2. **There is a 16 to 19 percent decrease in uniformity of light level over the room.**
3. **The results were used to provide a life-cycle cost credit to the better performing reflectors for the purpose of contract award, based on the premise that a 20 percent more efficient reflector could give the same amount of light as its competitor while saving 20 percent of energy costs by using a partial light output ballast.**

The installation of a specular optical reflector into a fluorescent luminaire, accompanied by removal of some lamps and ballast, has gained acceptance as a means to decrease lighting energy use by nearly one-half, without losing a proportional amount of useful light.[1] Other investigators[2,3] have found that illuminance levels decreased to 58-65 percent of original levels after similar modifications. These results agree with photometric data from one luminaire manufacturer[4] who offers several luminaires in two versions, differing only in the reflector material.

The CU tables show an increase of 11-26 percent in the CU values of the specular fixture relative to the new fixture with standard white diffuse reflector. Other manufacturers offer new fixtures with specular reflectors.[5] Because specular reflectors are incorporated into the design from the beginning, rather than as a retrofit add-on, we may expect to see still higher efficiencies and greater uniformity of illuminance.

As part of the contracting procedure in the Lighting Modification Program of the Department of Facilities Management at the University of California at Berkeley, we carried out a study to quantify this effect. In order to show the range of possibilities for this type of retrofit, we selected two different luminaire types in the same building for the performance test.

Four reflector manufacturers produced prototypes for testing encompassing design and material of their choice, and submitted bids to supply the reflectors. In order to encourage use of superior design and materials we incorporated into our request for bids a procedure to give performance-based credits to the bids of the better performing reflectors. Our results should be characteristic of the performance obtainable from retrofit specular reflectors designed under competitive conditions.

Two fixtures, (Type I, a 2' x 4' 4F40 with a wrap-around clear prismatic pattern #12 lens, and Type II, a 1' x 4' surface-mounted 2F40 with a flat clear prismatic pattern #12 lens), were loaned in the summer of 1987 to four reflector contractors for design of prototype reflectors, to be submitted with a bid to supply and install 1550 and 1000 units, respectively. The request for bid specified the manner in which a credit, proportional to performance, would be applied to the bids. The reflectors produced were of different design and materials, and are representative of typical commercially available products. The fixture and reflector characteristics are listed in Table 1.

Table 1. Optical Reflector Characteristics

	Ref-1	Ref-2	Ref-3	Ref-4
I	Anod. Alum.	Anod. Alum.+DEO	Anod. Alum.	Silv. Laminate
	Full coverage	Full coverage	Full coverage	Full coverage
	Relocate	Relocate	No relocate	No relocate
	R=%Base Flux=64	R=71	R=59	R=71
	Bid=$40.39	$40.80	$39.33	$63.06
	Adj. Bid=$29.84	$17.98	$39.33	$40.24
II	Anod. Alum.	Anod. Alum.+DEO	Anod. Alum.	Silv. Laminate
	Full coverage	Full coverage	Partial coverage	Full coverage
	Relocate	Relocate	No relocate	No relocate
	R=65	R=71	R=61	R=73
	$40.01	$27.50	$37.82	$46.14
	$34.47	$14.82	$37.82	$31.35

Notes:

Type I is a 2' x 4' pendant-mounted 4F40 with wraparound prismatic lens.
Type II is a 1' x 4' 2F40 surface-mounted fixture with flat prismatic lens.

Partial or Full **Coverage** refers to the size of the reflector relative to the size of the fixture. **Relocate** indicates that the original socket holders were removed and replaced with relocated sockets.

Anod. Alum. is high quality anodized aluminum. **DEO** indicates the addition of a dielectric overcoat to increase reflectance. **Silv. Laminate** refers to a coating of elemental silver deposited on plastic sheet which is adhered to aluminum substrate.

The **Bid** prices quoted were to clean the fixture and to supply and install the reflector (and socket mounting brackets, if any), to supply and install lamps, and to install a ballast supplied by the University. The **Adjusted Bid** is the performance-adjusted bid price as explained below in the section on Reflector Selection.

R=% Base Flux=% of flux from original fixture (after being cleaned and relamped).

PROCEDURE

The test procedure was similar for categories I and II. Both test luminaires were over twenty years old, and had rarely been cleaned. A classroom measuring 26.5 ft x 37.0 ft x 14.7 ft high, with fixtures suspended at 9.0 ft height, was selected for the Category I test. An office measuring 17.0 ft x 21.0 ft x 9.8 ft high, with fixtures suspended at 9.5 ft height, was selected for the Category II test.

First a fixture located near the center of the test room was thoroughly cleaned, and fitted with a full complement of 40-W F40/CW lamps which had been operated under controlled conditions in a lamp-life test rack for 4000 hours. The fixture's 277 V ballast was removed and replaced with energy efficient 120 V core and coil ballast (Advance R-2S40-1-TP for Category I, and Universal 412-L-SLH-TC-P for Category II) operating initially the full lamp complement, and subsequently one-half the lamps in the modified fixture. The test ballast was powered by a line voltage regulated power supply to ensure that illuminance measurements of modified fixtures would be obtained at the same power level.

Power consumption was monitored with a TIF 2000 Wattprobe, and found to remain within a 2 percent range during illuminance measurements on the test grid by means of a Tektronix J65 illuminance probe. All luminaires in the room were switched off except for the test fixture. Air temperature near the test fixture was monitored with a Fluke Y8103 Type K thermocouple, and building fans were switched off in a successful effort to maintain the room at constant temperature (20.5 C).

A test grid of twelve points, 2.5 ft above the floor, was laid out in one 8.65 ft x 8.75 ft quadrant of the luminaire. Figure 1 shows the grid for the two tests. Each reflector contractor in turn installed his reflector, most choosing to relocate lamp sockets as part of their design. The test lamps and the sockets were marked to ensure that each reflector was tested with the same lamps installed with the same orientation (end-for-end and rotationally about lamp axis). There was, of course, some lateral displacement of the lamps depending upon the contractor's design location for the lamp sockets. After waiting 10 minutes until the power consumption stabilized, illuminance measurements were taken on the grid.

B561

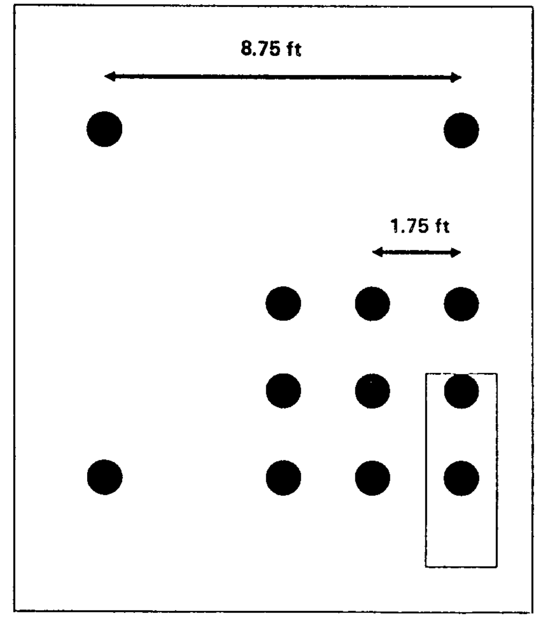


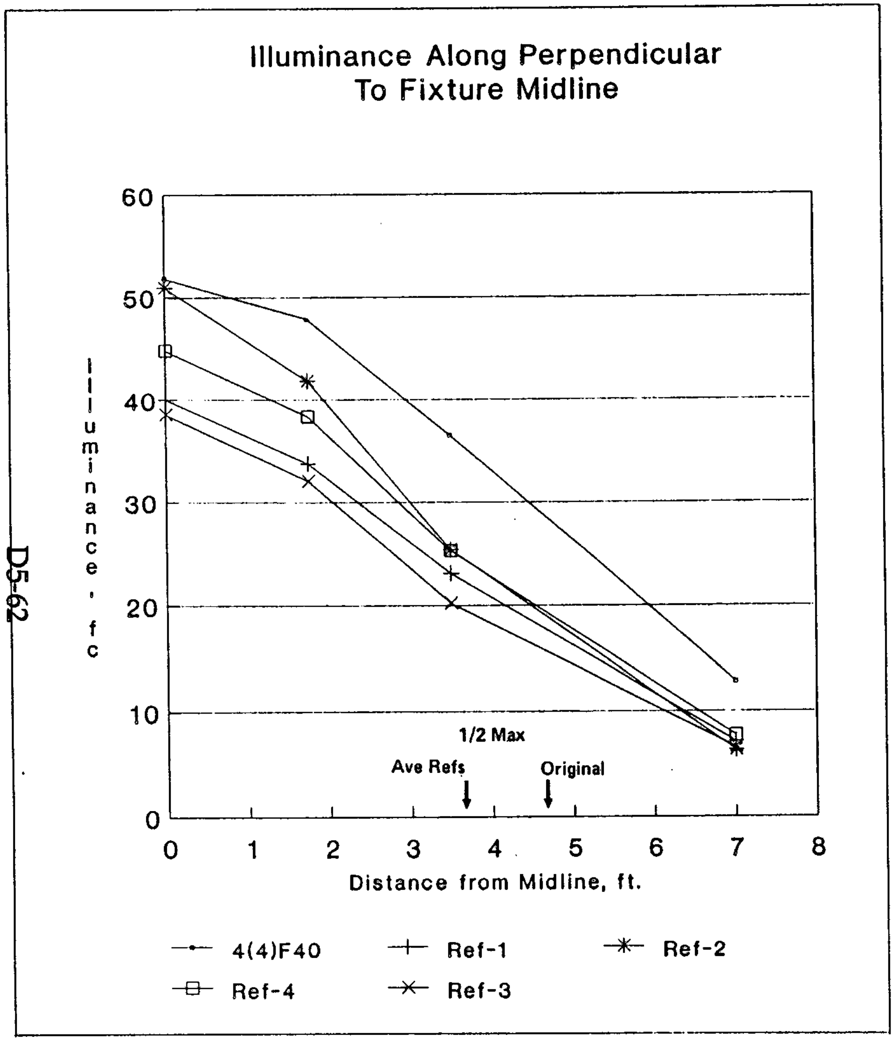
Figure 1. Photometer Locations

RESULTS

The measured power decreased, for the Category I luminaire, from 163 W (unmodified, 4 lamps) to 91 W (modified, 2 lamps). The unmodified Category II luminaire's power was not measured because it was powered by its original 277 V 2F40 ballast during the baseline (unmodified) illuminance measurements.

In Table 1 the photometric results are summarized by stating R, the percent of unmodified (base) luminaire flux delivered by the modified luminaire. This ranged from 59-71 percent for Category I, and from 61-73 percent for Category II.

Figures 2 and 3 plot the illuminance along a line perpendicular to the luminaires' major axis. The decreased lateral light distribution attributable to the reflectors is indicated by a 16-19 percent decrease in the distance at which the illuminance drops to one-half its maximum value (as indicated by the arrows labelled 1/2 Max).



D5-62

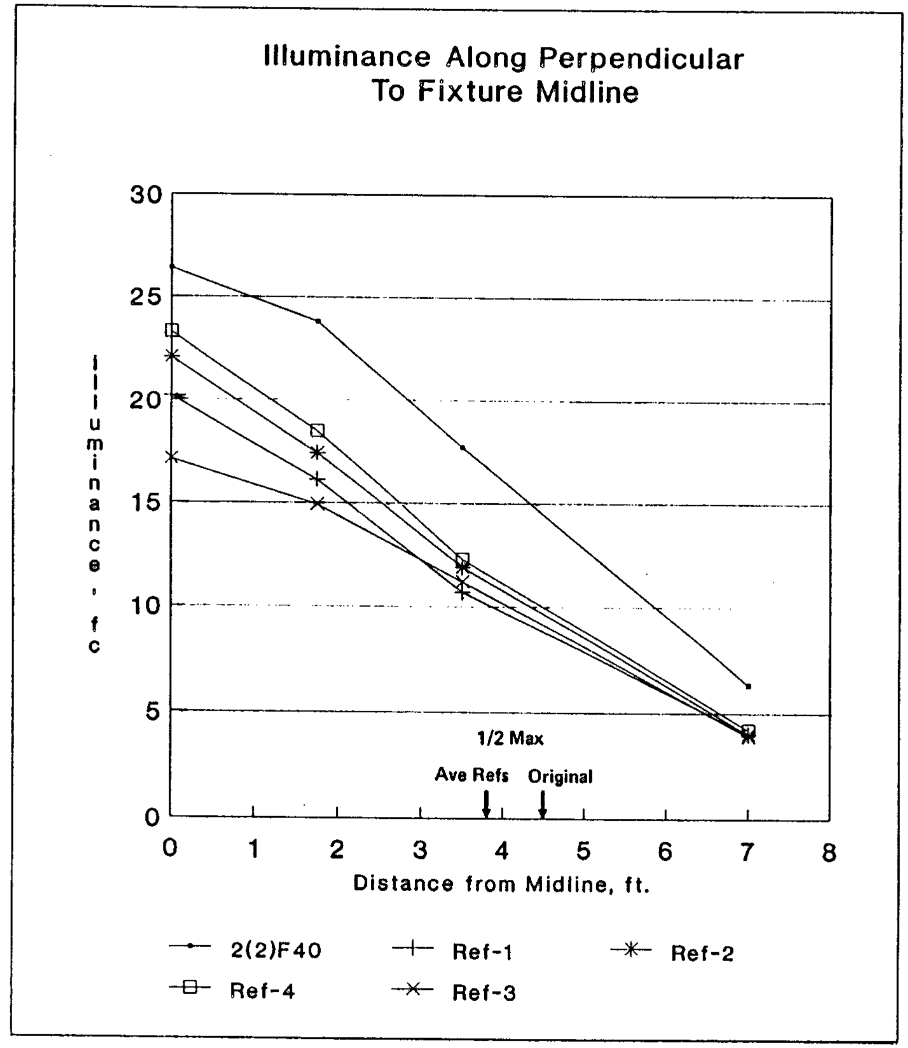


Figure 3. 2(2)F40 and 2(1)F40 + Reflector

REFLECTOR SELECTION

Rather than award the contract to the low bidder, the request for bids specified award to the low bidder after a downward adjustment that was proportional to the relative performance of the reflectors. This adjustment factor is derived as follows:

Let R be the ratio of flux delivered to four quadrants by the modified luminaire relative to the unmodified luminaire: (delamped and reflectorized)/(fully-lamped basecase).

Consider two reflectorized fixtures, 1 and 2, with ratios $R1 < R2$, (R calculated relative to the fully-lamped basecase). By using commercially available[6] "tuned" partial light output ballasts we can operate the poorer performing reflector at full power, Power1=W, and the better performing fixture 2 at partial power, Power2, so that its resultant ratio R2 equals that of fixture 1 operated at full power. That is, decrease Power2 until

$$\text{Power1} / \text{Power2} = W/\text{Power2} = R2/R1.$$

D5-63

Because the ballast used with fixture 1 consumes W watts, we have

$$\text{Power1} - \text{Power2} = W * [1 - (R1/R2)].$$

Therefore the life cycle avoided energy cost of retrofit fixture 2 relative to retrofit fixture 1 is, per fixture:

$$[1-(R1/R2)] * (W \text{ watts}) * (0.001 \text{ kWh/watt}) * (H \text{ hrs/yr}) * (E \text{ \$/kWh}) * [P/A],$$

where W=ballast power, H=annual operating hours, E=current cost of electricity, and [P/A] is the present worth factor encompassing anticipated lifetime, discount rate, and energy cost escalation rate.

In our contract award, this avoided energy cost factor was used to adjust downward the bids of the better performing reflectors. Thus all retrofit fixtures were evaluated as if they operated with partial power so as to have the same illuminance ratio as the worst performing reflector (which itself in effect receives an adjustment of $0.00).

The rationale for this adjustment is that we select as candidate spaces for reflector retrofit those spaces calculated (or measured) to have a factor of excess illuminance which we anticipate will be "corrected" by delamping and installation of a poorer performing reflector. The extra illuminance provided by a better performing reflector may be captured as energy savings through the use of partial light output ballast, or may be allowed to remain as an amenity with the use of full power ballast.

These adjustments ranged from $10.55-$22.82 for Category I (W=60, H=3000, E=0.075, and [P/A]=10), and from $5.54-$14.79 for Category II (W=30, H=4000, E=0.075, and P/A=10). The adjusted bids are shown as the last entry for each reflector in Table 1.

CONCLUSIONS

The removal of one-half the lamps combined with the installation of specular optical reflectors as a retrofit modification for fluorescent luminaires resulted in useful delivered flux in the range of 60-73 percent of that obtained with a cleaned older fully-lamped luminaire. This performance range is a function of reflector design and material. Lighting energy use can be approximately halved in spaces that can tolerate both a decrease in illuminance of this magnitude, and a decrease in uniformity characterized by a decrease of around 16 percent in the half-peak spacing.

This range in reflector performance can be quantified and used as input to a life-cycle cost analysis which in turn can be used to adjust the bid prices for award of a contract.

ACKNOWLEDGEMENTS

The author wishes to thank Robert Clear and Rudy Verderber of the Lighting Systems Research Group at Lawrence Berkeley Laboratory for their encouragement and helpful suggestions and comments.

REFERENCES AND FOOTNOTES

1. Chester K. Johnston, "Lighting Energy Management—With Reflectors," *Facilities Manager,* Vol. 1, No. 4, Winter 1985.
2. D. L. DiLaura and D. G. Kambich, "Luminaire Retrofit Performance—Commercial Building Lighting Systems," March 1987, EPRI Report EM-5094, Palo Alto, CA 94304.
3. T. K. McGowan, Fluorescent Fixture Reflector Inserts, General Electric Technical Information Series, No. 4162-871A, January 22, 1987.

4. Fixtures 101, 103, 325 are offered with and without a silver-laminate specular reflector. Wellmade Metal Products, Oakland, CA.
5. Brayer Lighting, San Francisco, CA
   Maximum Technology, Brisbane, CA
   Wellmade Metal Products, Oakland, CA
6. Electronic Ballast Technology, Inc., Torrance, CA.

About the Author

Jeffrey Kessel, P.E., is a graduate of the University of California at Berkeley, and is a registered professional engineer in the state. For the past four years he has directed the Campus Lighting Efficiency Improvement Project for the Energy Conservation Unit of the Office of Physical Resources of the University of California at Berkeley. Prior to that he was a staff scientist at Lawrence Berkeley Laboratory where he conducted research on energy-efficient windows and daylighting.

D5-64

The Collaborative Process in Stragic Energy Planning

LARRY B. BARRETT
Barrett Associates

A GROWING TREND FOR ENLIGHTENED ELECTRIC UTILITIES IS TO OPEN UP the process of planning for capacity additions and energy conservation. Traditionally, utilities made their plans first and then sought regulatory approval. Now, more and more utilities are seeking input into their plans from intervenors and others before approaching regulatory authorities.

Factions which were once adversaries in the hearing room may be found working more cooperatively in the conference room.

This is called the "Collaborative Process."

Typically, parties involved in the collaborative process are staff from the utility commission, the office of the consumer advocate and the state energy office. Environmental groups are also well represented.

In some cases customers are invited into the process. Usually the participating customers are large commercial and industrial energy consumers served by the utility. In a few cases, small customers are included.

WHAT IS THE COLLABORATIVE PROCESS?

The process has become known as the collaborative process in New England where it has been practiced most heavily since 1988.[1] However, other states have been active for some time. The Nevada Public Service Commission and electric utilities in Nevada started using a collaborative process in 1983. More recently, the states of Wisconsin, Michigan, and the District of Columbia have instituted a collaborative process.[2]

E M C ENGINEERS, INC.	JOB WSMR ESOS
Denver • Colorado Springs • Atlanta • Germany	SHEET NO. 1 OF 1
	CALCULATED BY TF DATE 8 JUN 92
	CHECKED BY ______ DATE ______
	SCALE ______

JULIAN:

WE USED ~~THE~~ NEW US DEPT OF LABOR RATE FOR ELECTRICIAN THAT I FAXED TO YOU ($33.87/hr) AND REDID THE LIGHTING ECOS FOR 1751 & 1830, THEN WE DID THOSE SAME 2 BLDGS AGAIN USING HI FREQ ELECTRONIC BALLASTS W/ RARE EARTH PHOSPHOR LAMP TECHNOLOGY. THE COMPARISONS ARE SHOWN BELOW. WE WILL RERUN THESE FOR ~~THE~~ REPORT USING $27.60/hr. LABOR RATE, WHICH IS ~~THE CORRECT RATE.~~

	WATTMISER SPB	WATTMISER SIR	HI FREQ SPB	HI FREQ SIR
1751	4.6	3.24	6.0	2.46
1830	4.8	3.05	6.3	2.35

CONCLUSION: AT THE $0.0221/KWH & $19.50/KW FOR WSMR, THE HI FREQ LIGHTING DOESN'T PAY AS WELL AS THE REDUCED WATTAGE LAMP + BALLAST TECHNOLOGY. THE EQUIPMENT COST IS STILL TOO HIGH.

WATTMISER

JOB ____________
CALCULATED BY: ________ DATE: ________
CHECKED BY: ________ DATE: ________
PAGE: ______ OF ______

LIGHTING
ENERGY SAVINGS CALCULATIONS

BLDG.	# HRS/YR	EXISTING # FIXTURES	EXISTING TYPE	EXISTING FIXTURE (KW)	EXISTING TOTAL (KW)	EXISTING KWH/YR	PROPOSED # FIXTURES	PROPOSED TYPE	PROPOSED FIXTURE (KW)	PROPOSED TOTAL (KW)	PROPOSED KWH/YR	DEMAND REDUCTION (KW)	ENERGY SAVINGS (KWH)	ANNUAL ELECTRICAL COST SAVINGS	CONSTRUCTION COST ESTIMATE
1743	2210	67	FL	0.096	6.432	14214.7	67	FL	0.071	4.757	10512.97	1.675	3701.8	$473.76	
	2210	57	FL	0.172	9.804	21666.8	57	FL	0.135	7.695	17005.95	2.109	4660.9	$596.51	
	2210	3	FL	0.181	0.543	1200.0	3	FL	0.140	0.420	928.2	0.123	271.8	$34.79	
	2210	118	IN	0.200	23.600	52156.0	70	FL	0.167	11.690	25834.9	11.910	26321.1	$3,368.64	
						89237.6					54282.0	15.817	34955.6	$4,473.70	$30,518.72
1751	2250	187	FL	0.096	17.952	40392.0	187	FL	0.071	13.277	29873.25	4.675	10518.8	$1,326.41	
	2250	6	FL	0.181	1.086	2443.5	6	FL	0.140	0.840	1890	0.246	553.5	$69.80	
	2250	3	FL	0.172	0.516	1161.0	3	FL	0.135	0.405	911.25	0.111	249.7	$31.49	
						43996.5					32674.5	5.032	11322.0	$1,427.70	$5,841.84
1753	2210	33	FL	0.096	3.168	7001.3	33	FL	0.071	2.343	5178.03	0.825	1823.3	$233.34	
	2210	26	IN	0.200	5.200	11492.0	12	MH	0.205	2.460	5436.6	2.740	6055.4	$774.98	
						18493.28					10614.63	3.565	7878.7	$1,008.33	$8,464.65
1790	2210	84	MV	0.460	38.640	85394.4	84	MH	0.406	34.125	75416.25	4.515	9978.1	$1,277.03	
	2210	13	IN	0.200	2.600	5746.0	0		0.000	0.000	0	2.600	5746.0	$735.39	
	2210	6	FL	0.181	1.086	2400.1	6	FL	0.140	0.840	1856.4	0.246	543.7	$69.58	
	2210	8	FL	0.096	0.768	1697.3	8	FL	0.071	0.568	1255.28	0.200	442.0	$56.57	
						95237.7					78527.9	7.561	16709.8	$2,138.56	$10,167.81
1794	2210	48	MV	0.460	22.080	48796.8	48	MH	0.290	13.920	30763.2	8.160	18033.6	$2,307.98	
	2210	48	IN	0.200	9.600	21216.0	0		0.000	0.000	0.0	9.600	21216.0	$2,715.27	
	2210	6	FL	0.096	0.576	1273.0	6	FL	0.071	0.426	941.5	0.150	331.5	$42.43	
						71285.8					31704.7	17.910	39581.1	$5,065.68	$25,989.61
1830	2250	157	FL	0.096	15.072	33912.0	157	FL	0.071	11.147	25080.7	3.925	8831.3	$1,113.62	
	2250	52	FL	0.181	9.412	21177.0	52	FL	0.140	7.280	16380.0	2.132	4797.0	$604.90	
						55089.0					41460.8	6.057	13628.2	$1,718.52	$7,464.86
1845		76	IN	EXPLOSION-PROOF FIXTURES - NOT ANALYZING											
	2210	6	FL	0.096	0.576	1273.0	6	FL	0.071	0.426	941.5	0.150	331.5	$42.43	
						1273.0					941.5	0.150	331.5	$42.43	$350.65
236	4368	57	IN	0.200	11.400	49795.2	12	MH	0.290	3.480	15200.6	7.920	34594.6	$2,617.82	
						49795.2					15200.6	7.920	34594.6	$2,617.82	$7,521.93

KEY:

FL = FLUORESCENT
IN = INCANDESCENT
MV = MERCURY VAPOR
MH = METAL HALIDE

WATTMISER

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #13 – P1751 – ENERGY EFFICIENT LIGHTING FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 03/18/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$5,842		
B. SIOH COST	(5.5% of 1A) =	$321		
C. DESIGN COST	(6.0% of 1A) =	$351		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$6,514		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$6,514

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	39	$250	15.23	$3,811	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		39	250.2		————>	$3,811

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $1,177
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $17,286

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $17,286

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,258
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = $1
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$1,428
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$21,096
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	3.24
7 SIMPLE PAYBACK (SPB)	(1F/4) =	4.56

WATTMISER

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	
CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1751		PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT, ENERGY EFFICIENT LAMPS	EA	398	2.19	871.62	0.05	33.87	674.01		$1,545.63
	8 FT, ENERGY EFFICIENT LAMPS	EA	6	5.12	30.72	0.05	33.87	10.16		$40.88
	ENERGY EFFICIENT BALLASTS									
	2-LAMP (4') FIXTURE BALLAST	EA	199	14.06	2797.94	0.20	33.87	1348.03		$4,145.97
	2-LAMP (8') FIXTURE BALLAST	EA	3	29.68	89.04	0.20	33.87	20.32		$109.36
	TOTAL THIS SHEET									$5,841.84

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

WATTMISER

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #13 - P1830 - ENERGY EFFICIENT LIGHTING FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 03/18/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$7,465	
B. SIOH COST	(5.5% of 1A) =		$411	
C. DESIGN COST	(6.0% of 1A) =		$448	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$8,323	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		------>	$8,323

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	47	$301	15.23	$4,587	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		47	301.2		------>	$4,587

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = $1,417
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $20,807

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $20,807

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $1,514
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = $1
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$1,719
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$25,393
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	3.05
7 SIMPLE PAYBACK (SPB)	(1F/4) =	4.84

WATTMISER

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ENERGY EFFICIENT LIGHTING IN BLDG. 1830

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	522	2.19	1143.18	0.05	33.87	884.01		$2,027.19
	ENERGY EFFICIENT BALLASTS	EA	261	14.06	3669.66	0.20	33.87	1768.01		$5,437.67
D5-70										
	TOTAL THIS SHEET									$7,464.86

Material Source: Lightbulb Supply Co., Denver, CO; Prices include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates include Overhead & Profit

JOB ______
CALCULATED BY: ______ DATE: ______
CHECKED BY: ______ DATE: ______
PAGE: ______ OF ______

LIGHTING
ENERGY SAVINGS CALCULATIONS

BLDG.	# HRS/YR	EXISTING # FIXTURES	EXISTING TYPE	EXISTING FIXTURE (KW)	EXISTING TOTAL (KW)	EXISTING KWH/YR	PROPOSED # FIXTURES	PROPOSED TYPE	PROPOSED FIXTURE (KW)	PROPOSED TOTAL (KW)	PROPOSED KWH/YR	DEMAND REDUCTION (KW)	ENERGY SAVINGS (KWH)	ANNUAL ELECTRICAL COST SAVINGS	CONSTRUCTION COST ESTIMATE
1751	2250	187	FL	0.096	17.952	40392.0	187	FL	0.058	10.846	24403.5	7.106	15988.5	$2,016.15	
	2250	6	FL	0.181	1.086	2443.5	6	FL	0.108	0.648	1458	0.438	985.5	$124.27	
	2250	3	FL	0.172	0.516	1161.0	3	FL	0.135	0.405	911.25	0.111	249.7	$31.49	
						43996.5					26772.8	7.655	17223.8	$2,171.91	$8,400.92
1830	2250	157	FL	0.096	15.072	33912.0	157	FL	0.058	9.106	20488.5	5.966	13423.5	$1,692.70	
	2250	52	FL	0.181	9.412	21177.0	52	FL	0.108	5.616	12636.0	3.796	8541.0	$1,077.02	
						55089.0					33124.5	9.762	21964.5	$2,769.72	$10,743.02

KEY:
- FL = FLUORESCENT
- IN = INCANDESCENT
- MV = MERCURY VAPOR
- MH = METAL HALIDE

HI FREQ, ELECTRONIC BALLASTS
w/ RARE EARTH PHOSPHOR LAMPS.

HI TECH LIGHTING

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #13 - P1751 - ENERGY EFFICIENT LIGHTING			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/08/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		~~$8,401~~	
B. SIOH COST	(5.5% of 1A) =		$462	
C. DESIGN COST	(6.0% of 1A) =		$504	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$9,367	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		------>	$9,367

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	59	$381	15.23	$5,797	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		59	380.6		------>	$5,797

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$1,177	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$17,286	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$17,286
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$1,913	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	$1	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$1,558
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$23,083
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.46
7 SIMPLE PAYBACK (SPB)	(1F/4) =	6.01

HIGH TECH LIGHTING

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1751	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER
WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT, ENERGY EFFICIENT LAMPS	EA	398	3.00	1194	0.05	27.60 ~~33.87~~	674.01		$1,868.01
	8 FT, ENERGY EFFICIENT LAMPS	EA	6	5.90	35.40	0.05	27.60 ~~33.87~~	10.16		$45.56
	ENERGY EFFICIENT BALLASTS									
D5-73	2-LAMP (4') FIXTURE BALLAST	EA	199	25.00	4975.00	0.20	27.60 ~~33.87~~	1348.03		$6,323.03
	2-LAMP (8') FIXTURE BALLAST	EA	3	48.00	144.00	0.20	27.60 ~~33.87~~	20.32		$164.32
	TOTAL THIS SHEET									$8,400.92

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

HIGH TECH LIGHTING.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #13 – P1830 – ENERGY EFFICIENT LIGHTING			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/08/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		~~$10,743~~	
B. SIOH COST	(5.5% of 1A) =		$591	
C. DESIGN COST	(6.0% of 1A) =		$645	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$11,978	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$11,978

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	75	$485	15.23	$7,393	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		75	485.4		————>	$7,393

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$1,417	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$20,807	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$20,807
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$2,440	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	$1	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$1,903
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$28,199
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	2.35
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	6.30

H I[illegible]ECH ~~COST EST~~ LIGHTING.

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR	ADDRESS
EMC ENGINEERS INC.	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed)	PROPOSED TOTAL CONTRACT PRICE
ENERGY EFFICIENT LIGHTING IN BLDG. 1830	

PURCHASE REQUEST NUMBER	PROJECT NUMBER	WORK LOCATION
		WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. T-8 LAMPS	EA	522	3.00	1566	0.05	27.60 ~~33.87~~	884.01		~~$2,450.01~~
	HIGH EFFICIECY ELECT. BALLASTS	EA	261	25.00	6525.00	0.20	27.60 ~~83.87~~	1768.01		~~$8,293.01~~
	TOTAL THIS SHEET									$10,743.02

D5-75

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range | REGION: 4 | PROJECT NO: DACA 63-91-C-0152

PROJECT TITLE: ECO #17 - BLDG. 1550 - IR HEATERS | FISCAL YEAR: 1992

DISCRETE PORTION NAME: TOTAL

ANALYSIS DATE: 06/11/92 | ECONOMIC LIFE: 15 | PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$10,313	
B. SIOH COST	(5.5% of 1A) =		$567	
C. DESIGN COST	(6.0% of 1A) =		$619	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$11,499	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		------->	$11,499

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	14	$250	10.79	$2,693	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	127	$281	12.38	$3,479	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		141	530.7		------->	$6,173

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$1,600	7	0.73	$1,168
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$1,600			$1,168

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $1,168

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $2,037

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =		$637
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =		$7,341
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =		0.64
7 SIMPLE PAYBACK (SPB)	(1F/4) =		18.04

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 - BLDG. S1554 - IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$10,313	
B. SIOH COST	(5.5% of 1A) =		$567	
C. DESIGN COST	(6.0% of 1A) =		$619	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$11,499	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		————>	$11,499

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	14	$250	10.79	$2,693	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	127	$281	12.38	$3,479	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		141	530.7		————>	$6,173

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$1,600	7	0.73	$1,168
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$1,600			$1,168

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $1,168

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $2,037

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$637
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$7,341
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.64
7	SIMPLE PAYBACK (SPB)	(1F/4) =	18.04

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 - BLDG. P1644 - IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$3,873	
B. SIOH COST	(5.5% of 1A) =		$213	
C. DESIGN COST	(6.0% of 1A) =		$232	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$4,318	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		——————>	$4,318

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	5	$98	10.79	$1,059	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	60	$133	12.38	$1,652	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		66	231.6		——————>	$2,711

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$1,200	7	0.73	$876
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$1,200			$876

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$876
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$895	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$312
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$3,587
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.83
7 SIMPLE PAYBACK (SPB)	(1F/4) =	13.86

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #17 - BLDG. P1680 - IR HEATERS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/11/92 ECONOMIC LIFE: 15 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$10,530	
B. SIOH COST	(5.5% of 1A) =		$579	
C. DESIGN COST	(6.0% of 1A) =		$632	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$11,741	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		———>	$11,741

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	3	$48	10.79	$520	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	239	$529	12.38	$6,548	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		242	577.1		———>	$7,068

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A–2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0	0	0.00	$0
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $2,332

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/15)) =	$577
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$7,068
6 DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR)	(5/1F) =	0.60
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	20.34

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 - BLDG. P1751 - IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$10,584		
B. SIOH COST	(5.5% of 1A) =	$582		
C. DESIGN COST	(6.0% of 1A) =	$635		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$11,801		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	--------->	$11,801	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	2	$43	10.79	$459	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	221	$490	12.38	$6,060	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		224	532.0		--------->	$6,519

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0
1 DISCOUNT FACTOR	(From Table A-2) =	10.67	
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$7,150	7	0.73	$5,220
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$7,150			$5,220

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$5,220
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$2,151	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.73	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$1,009
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$11,738
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	0.99
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	11.70

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 - BLDG. P1753 - IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$6,793	
B. SIOH COST	(5.5% of 1A) =		$374	
C. DESIGN COST	(6.0% of 1A) =		$408	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$7,575	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		---------->	$7,575

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	1	$23	10.79	$250	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	90	$198	12.38	$2,452	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		91	221.2		---------->	$2,702

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$4,550	7	0.73	$3,322
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$4,550			$3,322

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$3,322
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$892	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.47	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$525
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$6,023
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.80
7 SIMPLE PAYBACK (SPB)	(1F/4) =	14.44

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 - BLDG. P1788 - IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$5,677	
B. SIOH COST	(5.5% of 1A) =		$312	
C. DESIGN COST	(6.0% of 1A) =		$341	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$6,330	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		------------>	$6,330

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	1	$26	10.79	$279	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	110	$244	12.38	$3,025	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		112	270.2		------------>	$3,304

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$5,200	7	0.73	$3,796
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$5,200			$3,796

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$3,796
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$1,090	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.69	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$617
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$7,100
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.12
7 SIMPLE PAYBACK (SPB)	(1F/4) =	10.26

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 – BLDG. P1794 – IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$14,602	
B. SIOH COST	(5.5% of 1A) =		$803	
C. DESIGN COST	(6.0% of 1A) =		$876	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$16,281	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$16,281

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	5	$100	10.79	$1,084	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	364	$805	12.38	$9,970	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		369	905.8		————>	$11,054

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$11,700	7	0.73	$8,541
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$11,700			$8,541

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$8,541
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$3,648	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.90	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/15)) =	$1,686
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$19,595
6 DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.20
7 SIMPLE PAYBACK (SPB)	(1F/4) =	9.66

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 – BLDG. P1827 – IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$10,695	
B. SIOH COST	(5.5% of 1A) =		$588	
C. DESIGN COST	(6.0% of 1A) =		$642	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$11,925	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =		---------->	$11,925

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	1	$19	10.79	$203	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	225	$498	12.38	$6,162	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		226	516.5		---------->	$6,365

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$7,800	7	0.73	$5,694
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$7,800			$5,694

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $5,694

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $2,100

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.71

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/15)) =	$1,037
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$12,059
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.01
7	SIMPLE PAYBACK (SPB)	(1F/4) =	11.50

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	ECO #17 - BLDG. P1833 - IR HEATERS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/11/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$8,268		
B. SIOH COST	(5.5% of 1A) =	$455		
C. DESIGN COST	(6.0% of 1A) =	$496		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$9,219		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	---------->	$9,219	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	1	$21	10.79	$228	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	116	$257	12.38	$3,178	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		117	277.8		---------->	$3,406

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0
1 DISCOUNT FACTOR	(From Table A-2) =	10.67	
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$5,850	7	0.73	$4,271
b.	$0	0	0.00	$0
c.	$0	0	0.00	$0
d TOTAL	$5,850			$4,271

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$4,271
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$1,124	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.49	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$668
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$7,677
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.83
7 SIMPLE PAYBACK (SPB)	(1F/4) =	13.80

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO #17 – INSTALL IR HEATERS IN HIGH BAY AREA

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	BUILDING 1680 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	4	1620	6480	24	27.63	2652.48		$9,132.48
	APPURTENANCES	LS	4	226	904	MATERIALS	AND LABOR			$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	4			6.00	20.58	493.92		$493.92
	TOTAL									$10,530.40
2	BUILDING 1751 INSTALL IR HEATING SYSTEM (CRV-E180)	EA	2	2400	4800	28	27.63	1547.28		$6,347.28
	INSTALL IR HEATING SYSTEM (CRV-E120)	EA	1	1620	1620	24	27.63	663.12		$2,283.12
	APPURTENANCES	LS	5	226	1130	MATERIALS	AND LABOR			$1,130.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	10			4.00	20.58	823.2		$823.20
	TOTAL									$10,583.60
3	BUILDING 1753 INSTALL IR HEATING SYSTEM (CRV-E180)	EA	1	2400	2400	28	27.63	773.64		$3,173.64
	INSTALL IR HEATING SYSTEM (CRV-E120)	EA	1	1620	1620	24	27.63	663.12		$2,283.12
	APPURTENANCES	LS	3	226	678	MATERIALS	AND LABOR			$678.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	8			4.00	20.58	658.56		$658.56
	TOTAL									$6,793.32

Material Source: Means Electrical & Mechanical Cost Data, 1992; Roberts-Gordon, Inc.; Material Prices Incloude 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1.

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO #17 – INSTALL IR HEATERS IN HIGH BAY AREA

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST: Unit (4)	MATERIAL COST: Total (5)	LABOR COSTS: Manhours Mandays (6)	LABOR COSTS: Average Rate (7)	LABOR COSTS: Total (8)	Other Direct Costs (9)	Line Total (10)
4	BUILDING 1550 INSTALL IR HEATING SYSTEM (CRV-E360)	EA	1	4346	4346	32	27.63	884.16		$5,230.16
	APPURTENANCES	LS	4	226	904	MATERIALS	AND LABOR			$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	4			4.00	20.58	329.28		$329.28
	MAIN NATURAL GAS DISTRIBUTION PIPE	EA	1	3850	3850	MATERIALS	AND LABOR			$3,850.00
	TOTAL									$10,313.44
5	BUILDING 1554 INSTALL IR HEATING SYSTEM (CRV-E360)	EA	1	4346	4346	32	27.63	884.16		$5,230.16
	APPURTENANCES	LS	4	226	904	MATERIALS	AND LABOR			$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	4			4.00	20.58	329.28		$329.28
	MAIN NATURAL GAS DISTRIBUTION PIPE	EA	1	3850	3850	MATERIALS	AND LABOR			$3,850.00
	TOTAL									$10,313.44
6	BUILDING 1644 INSTALL IR HEATING SYSTEM (CRV-E180)	EA	1	2400	2400	28	27.63	773.64		$3,173.64
	APPURTENANCES	LS	2	226	452	MATERIALS	AND LABOR			$452.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	3			4.00	20.58	246.96		$246.96
	TOTAL									$3,872.60

Ma[illegible]ource: Means Electrical & Mechanical Cost Data, 1992; Roberts–Gordon, Inc.; Material Prices Incloude [illegible]verhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91–1.

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C–200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO #17 – INSTALL IR HEATERS IN HIGH BAY AREA

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
7	BUILDING 1788 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	2	1620	3240	24	27.63	1326.24		$4,566.24
	APPURTENANCES	LS	2	226	452	MATERIALS	AND LABOR			$452.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	8			4.00	20.58	658.56		$658.56
	TOTAL									$5,676.80
8	BUILDING 1794 INSTALL IR HEATING SYSTEM (CRV-E240)	EA	2	2770	5540	30	27.63	1657.8		$7,197.80
	INSTALL IR HEATING SYSTEM (CRV-E120)	EA	2	1620	3240	24	27.63	1326.24		$4,566.24
	APPURTENANCES	LS	6	226	1356	MATERIALS	AND LABOR			$1,356.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	18			4.00	20.58	1481.76		$1,481.76
	TOTAL									$14,601.80
9	BUILDING 1827 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	4	1620	6480	24	27.63	2652.48		$9,132.48
	APPURTENANCES	LS	4	226	904	MATERIALS	AND LABOR			$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	8			4.00	20.58	658.56		$658.56
	TOTAL									$10,695.04

Material Source: Means Electrical & Mechanical Cost Data, 1992; Roberts–Gordon, Inc.; Material Prices Incloude 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91–1.

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO #17 – INSTALL IR HEATERS IN HIGH BAY AREA

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

				MATERIAL COST		LABOR COSTS				
Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Unit (4)	Total (5)	Manhours Mandays (6)	Average Rate (7)	Total (8)	Other Direct Costs (9)	Line Total (10)
10	BUILDING 1833 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	3	1620	4860	24	27.63	1989.36		$6,849.36
	APPURTENANCES	LS	3	226	678	MATERIALS	AND LABOR			$678.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	9			4.00	20.58	740.88		$740.88
	TOTAL									$8,268.24

Mate[illegible]rce: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Sourc[illegible]s Cost Data, 1992, Rates Include Overhead & Profit

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO #17 – INSTALL IR HEATERS IN HIGH BAY AREA

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	APPURTENANCES:									
	NATURAL GAS PIPING	LF	10	1.38	13.80	0.131	35.81	46.91		$60.71
	ELECTRICAL CONDUIT	LF	30	5.50	165.00	MATERIALS	AND LABOR			$165.00
	TOTAL									$225.71

Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit

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**              T R A C E   6 0 0   A N A L Y S I S                         **
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ESOS STUDY AT WSMR - BUILDING 1550
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO #17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:50:56 1/20/92
Dataset Name: 1550 .TM

Tstat = 65°

System 1 Block UH - UNIT HEATERS

	****** COOLING COIL PEAK ******					*	CLG SPACE PEAK		*	HEATING COIL PEAK ****		
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-23,026	-23,026	6.85
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-174,939	-174,939	52.06
Wall Cond	0	0		0	0.00	*	0	0.00	*	-58,214	-58,214	17.32
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-3,831	-3,831	1.14
Infiltration	0			0	0.00	*	0	0.00	*	-76,052	-76,052	22.63
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-336,063	-336,063	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-336,063	-336,063	100.00

------COOLING COIL SELECTION------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

------AREAS------

	Gross Total	Glass (sf)	(%)
Floor	11,520		
Part	0		
ExFlr	125		
Roof	11,700	0	0
Wall	10,432	3,388	32

------HEATING COIL SELECTION------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-660.0	11,960	36.7	94.3
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-660.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,937
Supply	0	11,960
Mincfm	0	0
Return	0	11,960
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	1.04
Htg Btuh/SqFt	-57.29

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	94.3
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1550

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1550

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	11,960
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	11,960
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	11,960
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	11,960
System	1 Block	0	0	0	0	0	0	0	0	0	0	11,960

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1550

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Building		0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1550

--- B U I L D I N G   A R E A S ---

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
System	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
Building					11,520	0	125	0	0	11,700	3,388	32	7,044

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
Design Load	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-33,000	9	108	598.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-66,000	6	75	1,196.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-99,000	9	105	1,794.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-132,000	11	136	2,392.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-165,000	13	165	2,990.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-198,000	25	306	3,588.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-231,000	17	215	4,186.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-264,000	10	121	4,784.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-297,000	0	0	5,382.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-330,000	0	0	5,980.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-363,000	0	0	6,578.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-396,000	0	0	7,176.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-429,000	0	0	7,774.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-462,000	0	0	8,372.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-495,000	0	0	8,970.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-528,000	0	0	9,568.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-561,000	0	0	10,166.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-594,000	0	0	10,764.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-627,000	0	0	11,362.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-660,000	0	0	11,960.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,529	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	4,883	20	1,083	2	4
Feb	3,724	20	771	2	4
March	4,370	20	125	0	3
April	3,145	17	0	0	0
May	3,418	17	0	0	0
June	3,397	17	0	0	0
July	3,166	17	0	0	0
Aug	3,544	17	0	0	0
Sept	3,145	17	0	0	0
Oct	3,418	17	0	0	0
Nov	3,525	20	165	1	2
Dec	3,922	20	708	2	3
Total	43,657	20	2,851	7	4

Building Energy Consumption = 37,683 (Btu/Sq Ft/Year) Floor Area = 11,520 (Sq Ft)
Source Energy Consumption = 38,449 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 19.8 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total	0.0	0.00
Heating Equipment		
1 EQ2002 GAS FIRE TUBE STEAM	2.5	12.81
Sub Total	2.5	12.81
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	17.3	87.19
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	17.3	87.19
Grand Total	19.8	100.00

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**   T R A C E   6 0 0   A N A L Y S I S   **
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**   by   **
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ESOS STUDY AT WSMR - BUILDING 1550
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 4:53:15 1/21/92
Dataset Name: 1550 .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-20,779	-20,779	6.85
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-157,947	-157,947	52.07
Wall Cond	0	0		0	0.00	0	0.00	-52,535	-52,535	17.32
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-3,458	-3,458	1.14
Infiltration	0			0	0.00	0	0.00	-68,633	-68,633	22.62
Sub Total==>	0	0		0	0.00	0	0.00	-303,352	-303,352	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-303,352	-303,352	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	11,520		
Part	0		
ExFlr	125		
Roof	11,700	0	0
Wall	10,432	3,388	32

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-300.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-300.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,937
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-26.04

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1550

--------------------------------- A I R F L O W   H E A T I N G   L O A D S ---------------------------------
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
INFRARED HEATERS - 1550

----------------------------------- A I R F L O W   H E A T   G A I N   A N D   L O S S -----------------------------------
(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1550

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Building		0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1550

--- B U I L D I N G A R E A S ---

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
System	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
Building					11,520	0	125	0	0	11,700	3,388	32	7,044

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-15,000	3	24	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-30,000	2	19	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-45,000	9	79	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-60,000	3	26	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-75,000	1	8	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-90,000	5	45	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-105,000	7	60	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-120,000	5	42	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-135,000	3	23	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-150,000	6	55	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-165,000	14	122	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-180,000	11	90	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-195,000	5	43	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-210,000	15	125	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-225,000	11	93	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-240,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-255,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-270,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-285,000	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-300,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,906	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,412	18	675	3
Feb	3,066	18	460	3
March	3,552	18	16	2
April	3,145	17	0	0
May	3,418	17	0	0
June	3,397	17	0	0
July	3,166	17	0	0
Aug	3,544	17	0	0
Sept	3,145	17	0	0
Oct	3,418	17	0	0
Nov	3,160	18	40	2
Dec	3,253	18	391	2
Total	39,676	18	1,581	3

Building Energy Consumption = 25,482 (Btu/Sq Ft/Year)   Floor Area = 11,520 (Sq Ft)
Source Energy Consumption = 25,907 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility   ELECTRIC DEMAND

Peak Value   17.7   (kW)
Yearly Time of Peak   9 (hr)   1 (mo)

Hour 9 Month 1

Sub Total		0.0	0.00
Heating Equipment			
1	EQ2201 GAS FIRED UNIT HEATER	0.4	2.11
Sub Total		0.4	2.11
Sub Total		0.0	0.00
Sub Total		0.0	0.00
Miscellaneous			
Lights		17.3	97.89
Base Utilities		0.0	0.00
Misc Equipment		0.0	0.00
Sub Total		17.3	97.89
Grand Total		17.7	100.00

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** T R A C E 6 0 0 A N A L Y S I S **
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ESOS STUDY AT WSMR - BUILDING 1554
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO #17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:50:56 1/20/92
Dataset Name: 1554 .TM

Tstat = 65°

System 1 Block UH - UNIT HEATERS

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK *******

Peaked at Time ==> Mo/Hr: 0/ 0 * Mo/Hr: 0/ 0 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 * OADB: 0 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-23,026	-23,026	6.85
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-174,939	-174,939	52.06
Wall Cond	0	0		0	0.00	*	0	0.00	*	-58,214	-58,214	17.32
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-3,831	-3,831	1.14
Infiltration	0			0	0.00	*	0	0.00	*	-76,052	-76,052	22.63
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-336,063	-336,063	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-336,063	-336,063	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	11,520		
Part	0		
ExFlr	125		
Roof	11,700	0	0
Wall	10,432	3,388	32

-----------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-660.0	11,960	36.7	94.3
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-660.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,937
Supply	0	11,960
Mincfm	0	0
Return	0	11,960
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	1.04
Htg Btuh/SqFt	-57.29

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	94.3
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1554

A I R F L O W   H E A T I N G   L O A D S

(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone 1	Block	0	0	0	0	0	0	0	0	0
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0
System 1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1550

A I R F L O W   H E A T   G A I N   A N D   L O S S

(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	11,960
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	11,960
Zone 1	Block	0	0	0	0	0	0	0	0	0	0	11,960
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	11,960
System 1	Block	0	0	0	0	0	0	0	0	0	0	11,960

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1550

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Zone 1	Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
System 1	Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Building		0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1554

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
System	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
Building					11,520	0	125	0	0	11,700	3,388	32	7,044

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
Design Load	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-33,000	9	108	598.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-66,000	6	75	1,196.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-99,000	9	105	1,794.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-132,000	11	136	2,392.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-165,000	13	165	2,990.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-198,000	25	306	3,588.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-231,000	17	215	4,186.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-264,000	10	121	4,784.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-297,000	0	0	5,382.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-330,000	0	0	5,980.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-363,000	0	0	6,578.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-396,000	0	0	7,176.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-429,000	0	0	7,774.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-462,000	0	0	8,372.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-495,000	0	0	8,970.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-528,000	0	0	9,568.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-561,000	0	0	10,166.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-594,000	0	0	10,764.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-627,000	0	0	11,362.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-660,000	0	0	11,960.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,529	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	4,883	20	1,083	2	4
Feb	3,724	20	771	2	4
March	4,370	20	125	0	3
April	3,145	17	0	0	0
May	3,418	17	0	0	0
June	3,397	17	0	0	0
July	3,166	17	0	0	0
Aug	3,544	17	0	0	0
Sept	3,145	17	0	0	0
Oct	3,418	17	0	0	0
Nov	3,525	20	165	1	2
Dec	3,922	20	708	2	3
Total	43,657	20	2,851	7	4

Building Energy Consumption = 37,683 (Btu/Sq Ft/Year) **Floor Area = 11,520 (Sq Ft)**

Source Energy Consumption = 38,449 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 19.8 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			**0.0**	**0.00**
Heating Equipment				
1	EQ2002	GAS FIRE TUBE STEAM	**2.5**	**12.81**
Sub Total			**2.5**	**12.81**
Sub Total			**0.0**	**0.00**
Sub Total			**0.0**	**0.00**
Miscellaneous				
Lights			**17.3**	**87.19**
Base Utilities			**0.0**	**0.00**
Misc Equipment			**0.0**	**0.00**
Sub Total			**17.3**	**87.19**
Grand Total			**19.8**	**100.00**

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**                                                                            **
**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by           **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 1554
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 4:53:15 1/21/92
Dataset Name: 1554 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK *****

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-20,779	-20,779	6.85
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-157,947	-157,947	52.07
Wall Cond	0	0		0	0.00	0	0.00	-52,535	-52,535	17.32
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-3,458	-3,458	1.14
Infiltration	0			0	0.00	0	0.00	-68,633	-68,633	22.62
Sub Total==>	0	0		0	0.00	0	0.00	-303,352	-303,352	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-303,352	-303,352	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	11,520		
Part	0		
ExFlr	125		
Roof	11,700	0	0
Wall	10,432	3,388	32

------------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-300.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-300.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,937
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-26.04

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1550

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
INFRARED HEATERS - 1550

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Heating Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1550

B U I L D I N G   U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Building		0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1554

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
System	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
Building					11,520	0	125	0	0	11,700	3,388	32	7,044

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-15,000	3	24	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-30,000	2	19	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-45,000	9	79	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-60,000	3	26	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-75,000	1	8	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-90,000	5	45	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-105,000	7	60	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-120,000	5	42	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-135,000	3	23	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-150,000	6	55	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-165,000	14	122	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-180,000	11	90	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-195,000	5	43	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-210,000	15	125	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-225,000	11	93	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-240,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-255,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-270,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-285,000	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-300,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,906	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,412	18	675	3
Feb	3,066	18	460	3
March	3,552	18	16	2
April	3,145	17	0	0
May	3,418	17	0	0
June	3,397	17	0	0
July	3,166	17	0	0
Aug	3,544	17	0	0
Sept	3,145	17	0	0
Oct	3,418	17	0	0
Nov	3,160	18	40	2
Dec	3,253	18	391	2
Total	39,676	18	1,581	3

Building Energy Consumption = 25,482 (Btu/Sq Ft/Year)   Floor Area = 11,520 (Sq Ft)
Source Energy Consumption = 25,907 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

---------- U T I L I T Y   P E A K   C H E C K S U M S ----------

Utility ELECTRIC DEMAND

Peak Value 17.7 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.4	2.11
Sub Total			0.4	2.11
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			17.3	97.89
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			17.3	97.89
Grand Total			17.7	100.00

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

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**              T R A C E    6 0 0    A N A L Y S I S                 **
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**              by            **                                      **
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ESOS STUDY AT WSMR - BUILDING 1644
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO#17)

Weather File Code:	ELPASO.W
Location:	
Latitude:	31.0 (deg)
Longitude:	106.0 (deg)
Time Zone:	6
Elevation:	3,918 (ft)
Barometric Pressure:	25.8 (in. Hg)
Summer Clearness Number:	1.00
Winter Clearness Number:	1.00
Summer Design Dry Bulb:	98 (F)
Summer Design Wet Bulb:	64 (F)
Winter Design Dry Bulb:	24 (F)
Summer Ground Relectance:	0.20
Winter Ground Relectance:	0.20
Air Density:	0.0653 (Lbm/cuft)
Air Specific Heat:	0.2444 (Btu/lbm/F)
Density-Specific Heat Prod:	0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor:	3.9171 (Lb-min./hr/cuft)
Design Simulation Period:	May To October
System Simulation Period:	January To December
Cooling Load Methodology:	TETD/Time Averaging
Time/Date Program was Run:	9: 0:16 1/16/92
Dataset Name:	1644 .TM

System 1 Block UH - UNIT HEATERS

	COOLING COIL PEAK						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0						Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0						OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)		Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00		0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00		0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00		0	0.00	-44,764	-44,764	30.03
Glass Solar	0	0		0	0.00		0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00		0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00		0	0.00	-50,528	-50,528	33.89
Partition	0			0	0.00		0	0.00	0	0	0.00
Exposed Floor	0			0	0.00		0	0.00	-9,594	-9,594	6.44
Infiltration	0			0	0.00		0	0.00	-54,648	-54,648	36.66
Sub Total==>	0	0		0	0.00		0	0.00	-159,534	-159,534	107.02
Internal Loads											
Lights	0	0		0	0.00		0	0.00	0	0	0.00
People	0			0	0.00		0	0.00	0	0	0.00
Misc	0	0	0	0	0.00		0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00		0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00		0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00		0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00			0.00		1,013	-0.68
Ret. Fan Heat		0		0	0.00			0.00		0	0.00
Duct Heat Pkup		0		0	0.00			0.00		0	0.00
OV/UNDR Sizing	0			0	0.00		0	0.00	9,445	9,445	-6.34
Exhaust Heat		0	0	0	0.00			0.00		0	0.00
Terminal Bypass		0	0	0	0.00			0.00		0	0.00
Grand Total==>	0	0	0	0	0.00		0	0.00	-150,089	-149,076	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

(Entering DB/WB/HR; Leaving DB/WB/HR)

AREAS

	Gross Total	Glass (sf)	(%)
Floor	5,459		
Part	0		
ExFlr	312		
Roof	5,459	0	0
Wall	5,604	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-90.0	2,850	87.0	120.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-90.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	1,392
Supply	0	2,850
Mincfm	0	0
Return	0	2,850
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.52
Htg Btuh/SqFt	-16.49

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	120.0
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1644

A I R F L O W   H E A T I N G   L O A D S

(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1644

A I R F L O W   H E A T   G A I N   A N D   L O S S

(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	1,013	0	0	1,013	0	0	0	0	0	0	2,850
Zone	1 Total/Ave.	1,013	0	0	1,013	0	0	0	0	0	0	2,850
Zone	1 Block	1,013	0	0	1,013	0	0	0	0	0	0	2,850
System	1 Total/Ave.	1,013	0	0	1,013	0	0	0	0	0	0	2,850
System	1 Block	1,013	0	0	1,013	0	0	0	0	0	0	2,850

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1644

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
Building		0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1644

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	5,459	5,459	0	312	0	0	5,459	0	0	5,604
Zone	1 Total/Ave.				5,459	0	312	0	0	5,459	0	0	5,604
System	1 Total/Ave.				5,459	0	312	0	0	5,459	0	0	5,604
Building					5,459	0	312	0	0	5,459	0	0	5,604

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-4,500	6	96	142.5	0	0	0.0	0	0
5 - 10	0.0	0	0	-9,000	6	100	285.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-13,500	2	28	427.5	0	0	0.0	0	0
15 - 20	0.0	0	0	-18,000	4	75	570.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-22,500	2	43	712.5	0	0	0.0	0	0
25 - 30	0.0	0	0	-27,000	4	66	855.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-31,500	3	50	997.5	0	0	0.0	0	0
35 - 40	0.0	0	0	-36,000	1	19	1,140.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-40,500	4	75	1,282.5	0	0	0.0	0	0
45 - 50	0.0	0	0	-45,000	5	86	1,425.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-49,500	3	57	1,567.5	0	0	0.0	0	0
55 - 60	0.0	0	0	-54,000	4	66	1,710.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-58,500	9	160	1,852.5	0	0	0.0	0	0
65 - 70	0.0	0	0	-63,000	6	100	1,995.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-67,500	6	103	2,137.5	0	0	0.0	0	0
75 - 80	0.0	0	0	-72,000	7	128	2,280.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-76,500	9	152	2,422.5	0	0	0.0	0	0
85 - 90	0.0	0	0	-81,000	4	74	2,565.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-85,500	3	59	2,707.5	0	0	0.0	0	0
95 - 100	0.0	0	0	-90,000	11	185	2,850.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,038	0.0	0	0	0.0	0	8,760

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	2,591	12	508	1
Feb	2,336	12	370	1
March	2,282	12	65	1
April	1,908	10	0	0
May	2,073	10	0	0
June	2,061	10	0	0
July	1,920	10	0	0
Aug	2,150	10	0	0
Sept	1,908	10	0	0
Oct	2,073	10	0	0
Nov	2,055	12	79	1
Dec	2,402	12	342	1
Total	25,758	12	1,364	1

Building Energy Consumption = 41,097 (Btu/Sq Ft/Year)   Floor Area = 5,459 (Sq Ft)
Source Energy Consumption = 41,870 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 11.5 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2002	GAS FIRE TUBE STEAM	1.0	8.88
Sub Total			1.0	8.88
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			10.5	91.12
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			10.5	91.12
Grand Total			11.5	100.00

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**                                                                            **
**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by          **
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ESOS STUDY AT WSMR - BUILDING 1644
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:11:17 1/21/92
Dataset Name: 1644 .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak					Clg Space Peak		Heating Coil Peak		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-40,397	-40,397	28.06
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	-45,598	-45,598	31.67
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-8,658	-8,658	6.01
Infiltration	0			0	0.00	0	0.00	-49,317	-49,317	34.26
Sub Total==>	0	0		0	0.00	0	0.00	-143,970	-143,970	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	[illegible]
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-143,970	-143,970	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	5,459		
Part	0		
ExFlr	312		
Roof	5,459	0	0
Wall	5,604	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-120.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-120.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,392
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-21.98

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
IR HEATERS - BLDG. 1644

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone 1	Block	0	0	0	0	0	0	0	0	0
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0
System 1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
IR HEATERS - BLDG. 1644

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Heating Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone 1	Block	0	0	0	0	0	0	0	0	0	0	0
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System 1	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
IR HEATERS - BLDG. 1644

B U I L D I N G   U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
Zone 1	Total/Ave.	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
System 1	Total/Ave.	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
Building		0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

BUILDING AREAS - ALTERNATIVE 2
IR HEATERS - BLDG. 1644

-- B U I L D I N G A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	5,459	5,459	0	312	0	0	5,459	0	0	5,604
Zone	1 Total/Ave.				5,459	0	312	0	0	5,459	0	0	5,604
System	1 Total/Ave.				5,459	0	312	0	0	5,459	0	0	5,604
Building					5,459	0	312	0	0	5,459	0	0	5,604

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-6,000	3	34	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-12,000	4	45	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-18,000	5	57	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-24,000	5	61	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-30,000	5	60	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-36,000	6	68	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-42,000	6	73	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-48,000	6	73	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-54,000	7	75	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-60,000	12	138	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-66,000	14	161	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-72,000	7	83	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-78,000	7	79	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-84,000	8	89	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-90,000	4	48	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-96,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-102,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-108,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-114,000	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-120,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,616	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	2,113	11	316	1
Feb	1,894	11	221	1
March	2,161	11	13	1
April	1,908	10	0	0
May	2,073	10	0	0
June	2,061	10	0	0
July	1,920	10	0	0
Aug	2,150	10	0	0
Sept	1,908	10	0	0
Oct	2,073	10	0	0
Nov	1,921	11	19	1
Dec	2,012	11	192	1
Total	24,193	11	761	1

Building Energy Consumption = 29,065 (Btu/Sq Ft/Year)

Floor Area = 5,459 (Sq Ft)

Source Energy Consumption = 29,496 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 10.8 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.3	2.60
Sub Total			0.3	2.60
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			10.5	97.40
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			10.5	97.40
Grand Total			10.8	100.00

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**                                                                          **
**              T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                          **
**              by              **                                          **
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ESOS STUDY AT WSMR - BUILDING 1680
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 9:20: 1 1/16/92
Dataset Name: 1680 .TM

System 1 Block UH - UNIT HEATERS

	***** COOLING COIL PEAK *****					***** CLG SPACE PEAK *****		***** HEATING COIL PEAK *****		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-74,280	-74,280	14.05
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-224,953	-224,953	42.56
Wall Cond	0	0		0	0.00	0	0.00	-150,061	-150,061	28.39
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-15,929	-15,929	3.01
Infiltration	0			0	0.00	0	0.00	-69,473	-69,473	13.14
Sub Total==>	0	0		0	0.00	0	0.00	-534,695	-534,695	101.15
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		6,080	
Ret. Fan Heat		0		0	0.00		0.00		0	
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-534,695	-528,614	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	12,078		
Part	0		
ExFlr	518		
Roof	12,078	0	0
Wall	13,134	4,356	33

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-771.4	17,100	50.5	97.7
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-771.4			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	1,770
Supply	0	17,100
Mincfm	0	0
Return	0	17,100
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	1.42
Htg Btuh/SqFt	-63.87

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	97.7
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1680

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1680

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	6,080	0	0	6,080	0	0	0	0	0	0	17,100
Zone	1 Total/Ave.	6,080	0	0	6,080	0	0	0	0	0	0	17,100
Zone	1 Block	6,080	0	0	6,080	0	0	0	0	0	0	17,100
System	1 Total/Ave.	6,080	0	0	6,080	0	0	0	0	0	0	17,100
System	1 Block	6,080	0	0	6,080	0	0	0	0	0	0	17,100

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1680

B U I L D I N G   U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
Building		0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1680

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,078	12,078	0	518	0	0	12,078	4,356	33	8,778
Zone	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778
System	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778
Building					12,078	0	518	0	0	12,078	4,356	33	8,778

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-38,569	6	103	855.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-77,138	12	197	1,710.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-115,707	6	97	2,565.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-154,276	6	102	3,420.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-192,845	8	133	4,275.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-231,414	7	120	5,130.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-269,983	15	240	5,985.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-308,552	16	265	6,840.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-347,121	8	130	7,695.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-385,690	12	196	8,550.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-424,259	3	41	9,405.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-462,828	0	0	10,260.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-501,397	0	0	11,115.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-539,966	0	0	11,970.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-578,535	0	0	12,825.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-617,104	0	0	13,680.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-655,673	0	0	14,535.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-694,242	0	0	15,390.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-732,811	0	0	16,245.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-771,380	0	0	17,100.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,136	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	7,025	34	1,968	7
Feb	6,249	34	1,315	6
March	6,877	34	243	4
April	6,001	33	0	0
May	6,522	33	0	0
June	6,482	33	0	0
July	6,041	33	0	0
Aug	6,763	33	0	0
Sept	6,001	33	0	0
Oct	6,522	33	0	0
Nov	6,196	34	541	4
Dec	6,768	34	1,379	5
Total	77,447	34	5,445	7

Building Energy Consumption = 66,967 (Btu/Sq Ft/Year)   Floor Area = 12,078 (Sq Ft)
Source Energy Consumption = 68,361 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 34.0 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	1.0	2.94
Sub Total			1.0	2.94
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			33.0	97.06
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			33.0	97.06
Grand Total			34.0	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                          **
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ESOS STUDY AT WSMR - BUILDING 1680
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 2:41:50 1/21/92
Dataset Name: 1680 .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

	Cooling Coil Peak	CLG Space Peak	Heating Coil Peak
Peaked at Time ==>	Mo/Hr: 0/ 0	Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-67,033	-67,033	13.89
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-203,103	-203,103	42.08
Wall Cond	0	0		0	0.00	0	0.00	-135,421	-135,421	28.06
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-14,374	-14,374	2.98
Infiltration	0			0	0.00	0	0.00	-62,695	-62,695	12.99
Sub Total==>	0	0		0	0.00	0	0.00	-482,626	-482,626	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-482,626	-482,626	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	12,078		
Part	0		
ExFlr	518		
Roof	12,078	0	0
Wall	13,134	4,356	33

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-500.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-500.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,770
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-41.40

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
IR HEATERS BLDG. 1680

AIRFLOW HEATING LOADS
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
IR HEATERS BLDG. 1680

AIRFLOW HEAT GAIN AND LOSS
(At time of Coil Peak)

Room Number	Description	Heating										
		Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
IR HEATERS BLDG. 1680

BUILDING U-VALUES

Room Number	Description	Room U-Values (Btu/hr/sqft/F)									Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.		
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
Building		0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94

BUILDING AREAS - ALTERNATIVE 2
IR HEATERS BLDG. 1680

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,078	12,078	0	518	0	0	12,078	4,356	33	8,778
Zone	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778
System	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778
Building					12,078	0	518	0	0	12,078	4,356	33	8,778

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-25,000	4	50	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-50,000	6	64	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-75,000	3	35	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-100,000	4	42	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-125,000	7	83	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-150,000	8	85	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-175,000	7	81	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-200,000	3	39	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-225,000	8	91	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-250,000	6	67	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-275,000	15	172	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-300,000	6	72	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-325,000	7	78	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-350,000	13	149	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-375,000	1	10	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-400,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-425,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-450,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-475,000	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-500,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,642	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	6,911	34	1,237	5
Feb	5,955	34	811	5
March	6,803	34	47	3
April	6,001	33	0	0
May	6,522	33	0	0
June	6,482	33	0	0
July	6,041	33	0	0
Aug	6,763	33	0	0
Sept	6,001	33	0	0
Oct	6,522	33	0	0
Nov	6,208	34	151	3
Dec	6,469	34	809	4
Total	76,678	34	3,054	5

Building Energy Consumption = 46,956 (Btu/Sq Ft/Year)   Floor Area = 12,078 (Sq Ft)
Source Energy Consumption = 47,738 (Btu/Sq Ft/Year)

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***************************************************************************
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**                                                                       **
**              T R A C E   6 0 0   A N A L Y S I S                      **
**                                                                       **
**              by            **
**                                                                       **
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ESOS STUDY AT WSMR - BUILDING 1751
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:41:38 1/20/92
Dataset Name: 1751 .TM

System 1 Block UH - UNIT HEATERS

************************* COOLING COIL PEAK ******************************* CLG SPACE PEAK ************ HEATING COIL PEAK ***

	Cooling Coil Peak	Clg Space Peak	Heating Coil Peak
Peaked at Time ==>	Mo/Hr: 0/ 0	Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-92,697	-92,697	19.92
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-41,795	-41,795	8.98
Wall Cond	0	0		0	0.00	0	0.00	-121,673	-121,673	26.14
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-11,891	-11,891	2.55
Infiltration	0			0	0.00	0	0.00	-204,143	-204,143	43.86
Sub Total==>	0	0		0	0.00	0	0.00	-472,200	-472,200	101.45
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		6,747	-1.45
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-472,200	-465,453	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	18,087		
Part	0		
ExFlr	387		
Roof	18,087	0	0
Wall	11,668	809	7

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-894.4	18,975	41.8	91.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-894.4			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	0	5,200
Supply	0	18,975
Mincfm	0	0
Return	0	18,975
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	1.05
Htg Btuh/SqFt	-49.45

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	91.0
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1751

A I R F L O W   H E A T I N G   L O A D S

(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1751

A I R F L O W   H E A T   G A I N   A N D   L O S S

(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	HI-BAY AREA	6,747	0	0	6,747	0	0	0	0	0	0	18,975
Zone	1 Total/Ave.	6,747	0	0	6,747	0	0	0	0	0	0	18,975
Zone	1 Block	6,747	0	0	6,747	0	0	0	0	0	0	18,975
System	1 Total/Ave.	6,747	0	0	6,747	0	0	0	0	0	0	18,975
System	1 Block	6,747	0	0	6,747	0	0	0	0	0	0	18,975

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1751

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
1	HI-BAY AREA	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
Building		0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1751

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	HI-BAY AREA	1	1	18,087	18,087	0	387	0	0	18,087	809	7	10,859
Zone	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
System	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
Building					18,087	0	387	0	0	18,087	809	7	10,859

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

--------------------------------------- S Y S T E M   L O A D   P R O F I L E ---------------------------------------

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ---- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-44,720	16	422	948.8	0	0	0.0	0	0
5 - 10	0.0	0	0	-89,440	16	413	1,897.5	0	0	0.0	0	0
10 - 15	0.0	0	0	-134,160	20	518	2,846.2	0	0	0.0	0	0
15 - 20	0.0	0	0	-178,880	22	580	3,795.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-223,600	18	466	4,743.8	0	0	0.0	0	0
25 - 30	0.0	0	0	-268,320	10	256	5,692.5	0	0	0.0	0	0
30 - 35	0.0	0	0	-313,040	0	0	6,641.3	0	0	0.0	0	0
35 - 40	0.0	0	0	-357,760	0	0	7,590.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-402,480	0	0	8,538.8	0	0	0.0	0	0
45 - 50	0.0	0	0	-447,200	0	0	9,487.5	0	0	0.0	0	0
50 - 55	0.0	0	0	-491,920	0	0	10,436.3	0	0	0.0	0	0
55 - 60	0.0	0	0	-536,640	0	0	11,385.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-581,360	0	0	12,333.8	0	0	0.0	0	0
65 - 70	0.0	0	0	-626,080	0	0	13,282.5	0	0	0.0	0	0
70 - 75	0.0	0	0	-670,800	0	0	14,231.3	0	0	0.0	0	0
75 - 80	0.0	0	0	-715,520	0	0	15,180.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-760,240	0	0	16,128.8	0	0	0.0	0	0
85 - 90	0.0	0	0	-804,960	0	0	17,077.5	0	0	0.0	0	0
90 - 95	0.0	0	0	-849,680	0	0	18,026.3	0	0	0.0	0	0
95 - 100	0.0	0	0	-894,400	0	0	18,975.0	100	8,760	0.0	0	8,760
Hours Off	0.0	0	8,760	0	0	6,105	0.0	0	0			

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,177	15	1,749	6
Feb	2,873	15	1,325	6
March	3,305	15	343	3
April	2,647	15	0	0
May	2,876	15	0	0
June	2,859	15	0	0
July	2,664	15	0	0
Aug	2,983	15	0	0
Sept	2,647	15	0	0
Oct	2,876	15	0	0
Nov	2,943	15	524	3
Dec	3,071	15	1,276	5
Total	34,921	15	5,216	6

Building Energy Consumption = 35,429 (Btu/Sq Ft/Year)   Floor Area = 18,087 (Sq Ft)
Source Energy Consumption = 36,321 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 15.1 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total	0.0	0.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.5	3.63
Sub Total	0.5	3.63
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	14.5	96.37
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	14.5	96.37
Grand Total	15.1	100.00

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**                 T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                            **
**                 by          **
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ESOS STUDY AT WSMR - BUILDING 1751
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO # 17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:17:24 1/21/91
Dataset Name: 1751 .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ****

						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>		Mo/Hr: 0/ 0				Mo/Hr: 0/ 0			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				OADB: 0			OADB: 24	
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-83,653	-83,653	19.63
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-37,735	-37,735	8.85
Wall Cond	0	0		0	0.00	0	0.00	-109,803	-109,803	25.77
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-10,731	-10,731	2.52
Infiltration	0			0	0.00	0	0.00	-184,227	-184,227	43.23
Sub Total==>	0	0		0	0.00	0	0.00	-426,149	-426,149	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-426,149	-426,149	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB Deg F	Entering WB Deg F	Entering HR Grains	Leaving DB Deg F	Leaving WB Deg F	Leaving HR Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	18,087		
Part	0		
ExFlr	387		
Roof	18,087	0	0
Wall	11,668	809	7

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-450.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-450.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	5,200
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-24.88

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1751

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
INFRARED HEATERS - 1751

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1751

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	HI-BAY AREA	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
Building		0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1751

---------- B U I L D I N G   A R E A S ----------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	HI-BAY AREA	1	1	18,087	18,087	0	387	0	0	18,087	809	7	10,859
Zone	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
System	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
Building					18,087	0	387	0	0	18,087	809	7	10,859

ASHRAE 90 ANALYSIS - ALTERNATIVE 2
INFRARED HEATERS - 1751

---------- A S H R A E   9 0   A N A L Y S I S ----------

Overall Roof U-Value = 0.125 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.333 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.207 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 7.17 (Btu/Hr/Sq Ft)
Wall Overall Thermal Transfer Value (OTTVw) = 14.82 (Btu/Hr/Sq Ft)

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-22,500	12	225	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-45,000	7	131	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-67,500	5	95	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-90,000	9	177	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-112,500	10	189	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-135,000	15	275	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-157,500	9	172	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-180,000	15	293	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-202,500	8	149	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-225,000	8	147	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-247,500	2	41	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-270,000	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-292,500	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-315,000	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-337,500	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-360,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-382,500	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-405,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-427,500	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-450,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,866	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,166	15	1,190	4
Feb	2,776	15	853	4
March	3,061	15	50	2
April	2,647	15	0	0
May	2,876	15	0	0
June	2,859	15	0	0
July	2,664	15	0	0
Aug	2,983	15	0	0
Sept	2,647	15	0	0
Oct	2,876	15	0	0
Nov	2,729	15	114	2
Dec	2,959	15	798	3
Total	34,243	15	3,004	4

Building Energy Consumption = 23,069 (Btu/Sq Ft/Year)   Floor Area = 18,087 (Sq Ft)
Source Energy Consumption = 23,582 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 15.1 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.5	3.63
Sub Total			0.5	3.63
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			14.5	96.37
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			14.5	96.37
Grand Total			15.1	100.00

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**              T R A C E    6 0 0    A N A L Y S I S                        **
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**              by          **
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ESOS STUDY AT WSMR - BUILDING 1753
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC. ✓
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO# 17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:45:52 1/20/91
Dataset Name: 1753 .TM

System 1 Block UH - UNIT HEATERS

	COOLING COIL PEAK						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0						Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0						OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot		Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)		(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00		0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00		0	0.00	-80,459	-80,459	27.17
Roof Cond	0	0		0	0.00		0	0.00	-53,321	-53,321	18.00
Glass Solar	0	0		0	0.00		0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00		0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00		0	0.00	-33,728	-33,728	11.39
Partition	0			0	0.00		0	0.00	0	0	0.00
Exposed Floor	0			0	0.00		0	0.00	-11,208	-11,208	3.78
Infiltration	0			0	0.00		0	0.00	-117,449	-117,449	39.66
Sub Total==>	0	0		0	0.00		0	0.00	-296,165	-296,165	100.00
Internal Loads											
Lights	0	0		0	0.00		0	0.00	0	0	0.00
People	0			0	0.00		0	0.00	0	0	0.00
Misc	0	0	0	0	0.00		0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00		0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00		0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00		0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00			0.00		0	0.00
Ret. Fan Heat		0		0	0.00			0.00		0	0.00
Duct Heat Pkup		0		0	0.00			0.00		0	0.00
OV/UNDR Sizing	0			0	0.00		0	0.00	0	0	0
Exhaust Heat		0	0	0	0.00			0.00		0	0.00
Terminal Bypass		0	0	0	0.00			0.00		0	0.00
Grand Total==>	0	0	0	0	0.00		0	0.00	-296,165	-296,165	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	14,360		
Part	0		
ExFlr	365		
Roof	17,100	1,800	11
Wall	6,421	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-677.4	10,750	28.0	93.8
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-677.4			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	2,992
Supply	0	10,750
Mincfm	0	0
Return	0	10,750
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.75
Htg Btuh/SqFt	-47.17

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	93.8
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1753

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

		--- Ventilation --		---- Op. Vent.----		----- Reheat -----		---- Humidif. ----		
Room Number	Description	Airflow (Cfm)	Sensible (Btuh)	Airflow (Cfm)	Sensible (Btuh)	Airflow (Cfm)	Sensible (Btuh)	Airflow (Cfm)	Latent (Btuh)	Total (Btuh)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1753

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

		---- Heating ----										
Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0	0	10,750
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	10,750
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	10,750
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	10,750
System	1 Block	0	0	0	0	0	0	0	0	0	0	10,750

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1753

B U I L D I N G   U - V A L U E S

		---- Room U-Values (Btu/hr/sqft/F) ----									Room	Room
Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Mass (lb/ sqft)	Capac. (Btu/ sqft/F)
1	HI-BAY AREA	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
Zone	1 Total/Ave.	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
System	1 Total/Ave.	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
Building		0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1753

---------- B U I L D I N G   A R E A S ----------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	HI-BAY AREA	1	1	14,360	14,360	0	365	1,800	11	15,300	0	0	6,421
Zone	1 Total/Ave.				14,360	0	365	1,800	11	15,300	0	0	6,421
System	1 Total/Ave.				14,360	0	365	1,800	11	15,300	0	0	6,421
Building					14,360	0	365	1,800	11	15,300	0	0	6,421

ASHRAE 90 ANALYSIS - ALTERNATIVE 1
BASELINE BUILDING 1753

---------- A S H R A E   9 0   A N A L Y S I S ----------

Overall Roof U-Value = 0.181 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.128 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.167 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 19.70 (Btu/Hr/Sq Ft)
Wall Overall Thermal Transfer Value (OTTVw) = 5.93 (Btu/Hr/Sq Ft)

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-33,869	8	88	537.5	0	0	0.0	0	0
5 - 10	0.0	0	0	-67,738	6	64	1,075.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-101,606	13	139	1,612.5	0	0	0.0	0	0
15 - 20	0.0	0	0	-135,475	17	178	2,150.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-169,344	33	349	2,687.5	0	0	0.0	0	0
25 - 30	0.0	0	0	-203,213	23	240	3,225.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-237,082	0	0	3,762.5	0	0	0.0	0	0
35 - 40	0.0	0	0	-270,950	0	0	4,300.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-304,819	0	0	4,837.5	0	0	0.0	0	0
45 - 50	0.0	0	0	-338,688	0	0	5,375.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-372,557	0	0	5,912.5	0	0	0.0	0	0
55 - 60	0.0	0	0	-406,426	0	0	6,450.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-440,294	0	0	6,987.5	0	0	0.0	0	0
65 - 70	0.0	0	0	-474,163	0	0	7,525.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-508,032	0	0	8,062.5	0	0	0.0	0	0
75 - 80	0.0	0	0	-541,901	0	0	8,600.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-575,770	0	0	9,137.5	0	0	0.0	0	0
85 - 90	0.0	0	0	-609,639	0	0	9,675.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-643,507	0	0	10,212.5	0	0	0.0	0	0
95 - 100	0.0	0	0	-677,376	0	0	10,750.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,702	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	1,614	8	868	4
Feb	1,475	8	482	4
March	1,473	7	0	2
April	1,307	7	0	0
May	1,420	7	0	0
June	1,412	7	0	0
July	1,315	7	0	0
Aug	1,473	7	0	0
Sept	1,307	7	0	0
Oct	1,420	7	0	0
Nov	1,334	8	74	2
Dec	1,557	8	625	3
Total	17,107	8	2,049	4

Building Energy Consumption = 18,333 (Btu/Sq Ft/Year)   Floor Area = 14,360 (Sq Ft)
Source Energy Consumption = 18,774 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 7.7 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.5	6.51
Sub Total			0.5	6.51
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			7.2	93.49
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			7.2	93.49
Grand Total			7.7	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                       **
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**              by              **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 1753
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:33:28 1/21/91
Dataset Name: 1753 .TM

System 1 Block RAD - RADIATION

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>		Mo/Hr: 0/ 0				Mo/Hr: 0/ 0			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				OADB: 0			OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	-72,719	-72,719	27.20
Roof Cond	0	0		0	0.00	0	0.00	-48,119	-48,119	18.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	-30,437	-30,437	11.38
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-10,115	-10,115	3.78
Infiltration	0			0	0.00	0	0.00	-105,991	-105,991	39.64
Sub Total==>	0	0		0	0.00	0	0.00	-267,381	-267,381	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	[illegible]
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-267,381	-267,381	100.00

---------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	14,360		
Part	0		
ExFlr	365		
Roof	17,100	1,800	11
Wall	6,421	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-252.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-252.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	2,992
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-17.55

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1753

---------------------------------- A I R F L O W   H E A T I N G   L O A D S ----------------------------------
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone 1	Block	0	0	0	0	0	0	0	0	0
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0
System 1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
INFRARED HEATERS - 1753

---------------------------------- A I R F L O W   H E A T   G A I N   A N D   L O S S ----------------------------------
(At time of Coil Peak)

Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0	0	0
Zone 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone 1	Block	0	0	0	0	0	0	0	0	0	0	0
System 1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System 1	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1753

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
1	HI-BAY AREA	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
Zone 1	Total/Ave.	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
System 1	Total/Ave.	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
Building		0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23

Room U-Values in (Btu/hr/sqft/F).

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1753

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	HI-BAY AREA	1	1	14,360	14,360	0	365	1,800	11	15,300	0	0	6,421
Zone	1 Total/Ave.				14,360	0	365	1,800	11	15,300	0	0	6,421
System	1 Total/Ave.				14,360	0	365	1,800	11	15,300	0	0	6,421
Building					14,360	0	365	1,800	11	15,300	0	0	6,421

ASHRAE 90 ANALYSIS - ALTERNATIVE 2
INFRARED HEATERS - 1753

A S H R A E   9 0   A N A L Y S I S

Overall Roof U-Value = 0.181 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.128 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.167 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 19.70 (Btu/Hr/Sq Ft)
Wall Overall Thermal Transfer Value (OTTVw) = 5.93 (Btu/Hr/Sq Ft)

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-12,600	2	13	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-25,200	8	59	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-37,800	0	0	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-50,400	3	21	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-63,000	9	69	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-75,600	3	20	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-88,200	4	30	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-100,800	5	41	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-113,400	4	30	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-126,000	14	104	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-138,600	16	124	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-151,200	7	52	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-163,800	15	112	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-176,400	12	93	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-189,000	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-201,600	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-214,200	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-226,800	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-239,400	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-252,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,992	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	1,530	8	551	3
Feb	1,324	8	251	3
March	1,473	7	0	2
April	1,307	7	0	0
May	1,420	7	0	0
June	1,412	7	0	0
July	1,315	7	0	0
Aug	1,473	7	0	0
Sept	1,307	7	0	0
Oct	1,420	7	0	0
Nov	1,307	7	0	0
Dec	1,451	8	352	2
Total	16,738	8	1,154	3

Building Energy Consumption = 12,012 (Btu/Sq Ft/Year)   Floor Area = 14,360 (Sq Ft)
Source Energy Consumption = 12,260 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

--------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S ---------------------------------------

Utility ELECTRIC DEMAND

Peak Value 7.7 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total	0.0	0.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.5	6.51
Sub Total	0.5	6.51
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	7.2	93.49
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	7.2	93.49
Grand Total	7.7	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                          **
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ESOS STUDY AT WSMR - BUILDING 1788
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO#17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 15:43:59 1/20/91
Dataset Name: 1788 .TM

System 1 Block UH - UNIT HEATERS

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-17,564	-17,564	6.96
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-8,605	-8,605	3.41
Wall Cond	0	0		0	0.00	0	0.00	-139,333	-139,333	55.21
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-12,115	-12,115	4.80
Infiltration	0			0	0.00	0	0.00	-74,747	-74,747	29.62
Sub Total==>	0	0		0	0.00	0	0.00	-252,365	-252,365	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-252,365	-252,365	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	9,520		
Part	0		
ExFlr	394		
Roof	9,520	0	0
Wall	6,006	167	3

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-464.5	8,800	39.8	95.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-464.5			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	1,904
Supply	0	8,800
Mincfm	0	0
Return	0	8,800
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.92
Htg Btuh/SqFt	-48.79

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	95.0
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1788

--------------------------------- B U I L D I N G   U - V A L U E S ---------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	HIGH BAY 1	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.603	0.000	65.2	13.93
2	HIGH BAY 2	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.564	0.000	69.6	14.82
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
Building		0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1788

--------------------------------- B U I L D I N G   A R E A S ---------------------------------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	HIGH BAY 1	1	1	4,760	4,760	0	394	0	0	4,760	51	2	2,664
2	HIGH BAY 2	1	1	4,760	4,760	0	0	0	0	4,760	115	4	3,176
Zone	1 Total/Ave.				9,520	0	394	0	0	9,520	167	3	5,840
System	1 Total/Ave.				9,520	0	394	0	0	9,520	167	3	5,840
Building					9,520	0	394	0	0	9,520	167	3	5,840

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-23,224	19	466	440.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-46,449	18	426	880.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-69,673	15	368	1,320.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-92,897	18	427	1,760.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-116,122	16	385	2,200.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-139,346	10	241	2,640.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-162,570	4	86	3,080.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-185,794	0	0	3,520.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-209,019	0	0	3,960.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-232,243	0	0	4,400.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-255,467	0	0	4,840.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-278,692	0	0	5,280.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-301,916	0	0	5,720.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-325,140	0	0	6,160.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-348,365	0	0	6,600.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-371,589	0	0	7,040.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-394,813	0	0	7,480.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-418,037	0	0	7,920.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-441,262	0	0	8,360.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-464,486	0	0	8,800.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,361	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,734	18	858	3
Feb	3,376	18	683	3
March	3,943	18	177	2
April	3,292	18	0	0
May	3,578	18	0	0
June	3,556	18	0	0
July	3,314	18	0	0
Aug	3,710	18	0	0
Sept	3,292	18	0	0
Oct	3,578	18	0	0
Nov	3,516	18	169	1
Dec	3,538	18	582	2
Total	42,426	18	2,469	3

Building Energy Consumption = 41,147 (Btu/Sq Ft/Year)
Source Energy Consumption = 41,949 (Btu/Sq Ft/Year)

Floor Area = 9,520 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 18.5 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.4	2.15
Sub Total			0.4	2.15
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			18.1	97.85
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			18.1	97.85
Grand Total			18.5	100.00

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**                  T R A C E   6 0 0   A N A L Y S I S                       **
**                                                                            **
**                  by              **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 1788
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO #17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:49:29 1/21/91
Dataset Name: 1788 .TM

System 1 Block UH - UNIT HEATERS

************************ COOLING COIL PEAK ****************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK		CLG SPACE PEAK	HEATING COIL PEAK
Peaked at Time ==>	Mo/Hr: 0/ 0		Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0		OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-15,851	-15,851	6.96
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-7,769	-7,769	3.41
Wall Cond	0	0		0	0.00	0	0.00	-125,740	-125,740	55.21
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-10,933	-10,933	4.80
Infiltration	0			0	0.00	0	0.00	-67,454	-67,454	29.62
Sub Total==>	0	0		0	0.00	0	0.00	-227,747	-227,747	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	
Ret. Fan Heat		0		0	0.00		0.00		0	
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-227,747	-227,747	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	9,520		
Part	0		
ExFlr	394		
Roof	9,520	0	0
Wall	6,006	167	3

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-200.0	8,800	64.3	88.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-200.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,904
Supply	0	8,800
Mincfm	0	0
Return	0	8,800
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.92
Htg Btuh/SqFt	-21.01

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	88.0
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1788

B U I L D I N G U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	HIGH BAY 1	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.603	0.000	65.2	13.93
2	HIGH BAY 2	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.564	0.000	69.6	14.82
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
Building		0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1788

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	HIGH BAY 1	1	1	4,760	4,760	. 0	394	0	0	4,760	51	2	2,664
2	HIGH BAY 2	1	1	4,760	4,760	0	0	0	0	4,760	115	4	3,176
Zone	1 Total/Ave.				9,520	0	394	0	0	9,520	167	3	5,840
System	1 Total/Ave.				9,520	0	394	0	0	9,520	167	3	5,840
Building					9,520	0	394	0	0	9,520	167	3	5,840

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-10,000	12	191	440.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-20,000	6	103	880.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-30,000	8	122	1,320.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-40,000	4	61	1,760.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-50,000	7	114	2,200.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-60,000	7	115	2,640.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-70,000	10	154	3,080.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-80,000	8	126	3,520.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-90,000	12	190	3,960.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-100,000	10	163	4,400.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-110,000	4	70	4,840.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-120,000	6	90	5,280.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-130,000	5	87	5,720.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-140,000	2	29	6,160.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-150,000	0	0	6,600.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-160,000	0	0	7,040.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-170,000	0	0	7,480.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-180,000	0	0	7,920.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-190,000	0	0	8,360.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-200,000	0	0	8,800.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,145	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,742	18	556	2
Feb	3,310	18	410	2
March	3,758	18	29	1
April	3,292	18	0	0
May	3,578	18	0	0
June	3,556	18	0	0
July	3,314	18	0	0
Aug	3,710	18	0	0
Sept	3,292	18	0	0
Oct	3,578	18	0	0
Nov	3,320	18	30	1
Dec	3,564	18	339	2
Total	42,013	18	1,365	2

Building Energy Consumption = 29,401 (Btu/Sq Ft/Year)   Floor Area = 9,520 (Sq Ft)
Source Energy Consumption = 29,844 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 18.5 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total			0.0	0.00
Heating Equipment				
1	EQ2201	GAS FIRED UNIT HEATER	0.4	2.15
Sub Total			0.4	2.15
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			18.1	97.85
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			18.1	97.85
Grand Total			18.5	100.00

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**                 T R A C E   6 0 0   A N A L Y S I S                     **
**                                                                         **
**                 by             **
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ESOS STUDY AT WSMR - BUILDING 1794
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 8:48:15 1/20/92
Dataset Name: 1794 .TM

System 1 Block UH - UNIT HEATERS

****** COOLING COIL PEAK ******						*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-185,919	-185,919	25.47
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-110,117	-110,117	15.08
Wall Cond	0	0		0	0.00	*	0	0.00	*	-209,775	-209,775	28.73
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-18,850	-18,850	2.58
Infiltration	0			0	0.00	*	0	0.00	*	-205,406	-205,406	28.14
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-730,067	-730,067	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	[illegible]
Sup. Fan Heat				0	0.00	*		0.00	*		0	[illegible]
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-730,067	-730,067	100.00

---COOLING COIL SELECTION---

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

---AREAS---

	Gross Total	Glass (sf)	(%)
Floor	17,441		
Part	0		
ExFlr	613		
Roof	17,441	0	0
Wall	10,926	2,132	20

---HEATING COIL SELECTION---

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,209.0	21,075	41.3	101.2
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,209.0			

---AIRFLOWS (cfm)---

Type	Cooling	Heating
Vent	0	0
Infil	0	5,232
Supply	0	21,075
Mincfm	0	0
Return	0	21,075
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	1.21
Htg Btuh/SqFt	-69.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	101.2
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1794

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	ROOM 1	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1794

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	ROOM 1	0	0	0	0	0	0	0	0	0	0	21,075
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	21,075
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	21,075
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	21,075
System	1 Block	0	0	0	0	0	0	0	0	0	0	21,075

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1794

B U I L D I N G   U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Building		0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1794

---------- B U I L D I N G   A R E A S ----------

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	17,441	17,441	0	613	0	0	17,441	2,132	20	8,794
Zone	1 Total/Ave.				17,441	0	613	0	0	17,441	2,132	20	8,794
System	1 Total/Ave.				17,441	0	613	0	0	17,441	2,132	20	8,794
Building					17,441	0	613	0	0	17,441	2,132	20	8,794

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-60,450	13	320	1,053.7	0	0	0.0	0	0
5 - 10	0.0	0	0	-120,900	15	393	2,107.5	0	0	0.0	0	0
10 - 15	0.0	0	0	-181,350	13	339	3,161.3	0	0	0.0	0	0
15 - 20	0.0	0	0	-241,800	15	379	4,215.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-302,250	18	449	5,268.8	0	0	0.0	0	0
25 - 30	0.0	0	0	-362,700	14	363	6,322.5	0	0	0.0	0	0
30 - 35	0.0	0	0	-423,150	9	238	7,376.3	0	0	0.0	0	0
35 - 40	0.0	0	0	-483,600	2	60	8,430.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-544,050	0	0	9,483.8	0	0	0.0	0	0
45 - 50	0.0	0	0	-604,500	0	0	10,537.5	0	0	0.0	0	0
50 - 55	0.0	0	0	-664,950	0	0	11,591.3	0	0	0.0	0	0
55 - 60	0.0	0	0	-725,400	0	0	12,645.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-785,850	0	0	13,698.8	0	0	0.0	0	0
65 - 70	0.0	0	0	-846,300	0	0	14,752.5	0	0	0.0	0	0
70 - 75	0.0	0	0	-906,750	0	0	15,806.3	0	0	0.0	0	0
75 - 80	0.0	0	0	-967,200	0	0	16,860.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-1,027,650	0	0	17,913.8	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,088,100	0	0	18,967.5	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,148,550	0	0	20,021.3	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,209,000	0	0	21,075.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,219	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	5,886	28	2,835	8
Feb	5,323	28	2,207	8
March	5,819	28	579	4
April	4,984	27	0	0
May	5,416	27	0	0
June	5,383	27	0	0
July	5,016	27	0	0
Aug	5,616	27	0	0
Sept	4,984	27	0	0
Oct	5,416	27	0	0
Nov	5,303	28	711	4
Dec	5,596	28	2,049	7
Total	64,742	28	8,381	8

Building Energy Consumption = 60,725 (Btu/Sq Ft/Year)   Floor Area = 17,441 (Sq Ft)
Source Energy Consumption = 62,212 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 28.3 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total	0.0	0.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.9	3.18
Sub Total	0.9	3.18
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	27.4	96.82
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	27.4	96.82
Grand Total	28.3	100.00

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**            T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                          **
**            by           **
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ESOS STUDY AT WSMR - BUILDING 1794
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 4:40:22 1/21/92
Dataset Name: 1794 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK	CLG SPACE PEAK	HEATING COIL PEAK
Peaked at Time ==>	Mo/Hr: 0/ 0	Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-167,780	-167,780	25.46
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-99,422	-99,422	15.09
Wall Cond	0	0		0	0.00	0	0.00	-189,309	-189,309	28.73
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-17,011	-17,011	2.58
Infiltration	0			0	0.00	0	0.00	-185,366	-185,366	28.13
Sub Total==>	0	0		0	0.00	0	0.00	-658,888	-658,888	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-658,888	-658,888	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	17,441		
Part	0		
ExFlr	613		
Roof	17,441	0	0
Wall	10,926	2,132	20

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-700.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-700.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	5,232
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-40.14

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1794

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	ROOM 1	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
INFRARED HEATERS - 1794

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Heating Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	ROOM 1	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1794

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Building		0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1794

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	17,441	17,441	0	613	0	0	17,441	2,132	20	8,794
Zone	1 Total/Ave.				17,441	0	613	0	0	17,441	2,132	20	8,794
System	1 Total/Ave.				17,441	0	613	0	0	17,441	2,132	20	8,794
Building					17,441	0	613	0	0	17,441	2,132	20	8,794

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.0	0	0	-35,000	7	123	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-70,000	10	186	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-105,000	11	194	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-140,000	7	121	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-175,000	10	179	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-210,000	7	137	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-245,000	12	228	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-280,000	10	182	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-315,000	12	211	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-350,000	8	149	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-385,000	6	109	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-420,000	1	10	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-455,000	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-490,000	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-525,000	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-560,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-595,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-630,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-665,000	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-700,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,931	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	5,470	28	1,895	6
Feb	4,963	28	1,344	6
March	5,676	28	116	3
April	4,984	27	0	0
May	5,416	27	0	0
June	5,383	27	0	0
July	5,016	27	0	0
Aug	5,616	27	0	0
Sept	4,984	27	0	0
Oct	5,416	27	0	0
Nov	5,028	28	191	3
Dec	5,188	28	1,196	5
Total	63,140	28	4,742	6

Building Energy Consumption = 39,543 (Btu/Sq Ft/Year)   Floor Area = 17,441 (Sq Ft)
Source Energy Consumption = 40,384 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 27.8 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total		0.0	0.00
Heating Equipment			
1 EQ2201	GAS FIRED UNIT HEATER	0.4	1.34
Sub Total		0.4	1.34
Sub Total		0.0	0.00
Sub Total		0.0	0.00
Miscellaneous			
Lights		27.4	98.66
Base Utilities		0.0	0.00
Misc Equipment		0.0	0.00
Sub Total		27.4	98.66
Grand Total		27.8	100.00

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**                  T R A C E   6 0 0   A N A L Y S I S                    **
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**                  by              **
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ESOS STUDY AT WSMR - BUILDING 1827
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO#17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14: 9:55 1/19/92
Dataset Name: 1827 .TM

Tstat = 65°F

System 1 Block UH - UNIT HEATERS

************************ COOLING COIL PEAK						*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>		Mo/Hr: 0/ 0				*	Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				*	OADB: 0		*		OADB: 24	
	Space	Ret. Air	Ret. Air	Net	Percnt	*	Space	Percnt	*	Space Peak	Coil Peak	Percnt
	Sens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensible	Of Tot	*	Space Sens	Tot Sens	Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-116,407	-116,407	27.39
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-18,247	-18,247	4.29
Wall Cond	0	0		0	0.00	*	0	0.00	*	-158,930	-158,930	37.39
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-19,988	-19,988	4.70
Infiltration	0			0	0.00	*	0	0.00	*	-111,460	-111,460	26.22
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-425,032	-425,032	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0[illegible]
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.[illegible]
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-425,032	-425,032	100.00

-----COOLING COIL SELECTION-----

	Total Capacity		Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR		
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	14,196		
Part	0		
ExFlr	650		
Roof	14,196	0	0
Wall	10,534	353	3

-----HEATING COIL SELECTION-----

	Capacity	Coil Airfl	Ent	Lvg
	(Mbh)	(cfm)	Deg F	Deg F
Main Htg	-788.0	13,200	36.3	98.6
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-788.0			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	0	2,839
Supply	0	13,200
Mincfm	0	0
Return	0	13,200
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.93
Htg Btuh/SqFt	-55.51

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	98.6
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1827

AIRFLOW HEATING LOADS
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1827

AIRFLOW HEAT GAIN AND LOSS
(At time of Coil Peak)

Room Number	Description	Heating Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	13,200
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	13,200
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	13,200
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	13,200
System	1 Block	0	0	0	0	0	0	0	0	0	0	13,200

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1827

BUILDING U-VALUES

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Building		0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1827

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	14,196	14,196	0	650	0	0	14,196	353	3	10,180
Zone	1 Total/Ave.				14,196	0	650	0	0	14,196	353	3	10,180
System	1 Total/Ave.				14,196	0	650	0	0	14,196	353	3	10,180
Building					14,196	0	650	0	0	14,196	353	3	10,180

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

---------- S Y S T E M   L O A D   P R O F I L E ----------

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-39,398	9	241	660.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-78,797	18	483	1,320.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-118,195	20	561	1,980.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-157,594	19	515	2,640.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-196,992	15	423	3,300.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-236,390	13	350	3,960.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-275,789	7	180	4,620.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-315,187	0	0	5,280.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-354,586	0	0	5,940.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-393,984	0	0	6,600.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-433,382	0	0	7,260.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-472,781	0	0	7,920.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-512,179	0	0	8,580.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-551,578	0	0	9,240.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-590,976	0	0	9,900.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-630,374	0	0	10,560.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-669,773	0	0	11,220.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-709,171	0	0	11,880.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-748,570	0	0	12,540.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-787,968	0	0	13,200.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,007	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	2,285	10	1,856	5
Feb	2,066	10	1,405	5
March	2,304	10	299	2
April	1,757	10	0	0
May	1,909	10	0	0
June	1,898	10	0	0
July	1,768	10	0	0
Aug	1,980	10	0	0
Sept	1,757	10	0	0
Oct	1,909	10	0	0
Nov	2,078	10	559	3
Dec	2,215	10	1,410	4
Total	23,927	10	5,530	5

Building Energy Consumption = 44,705 (Btu/Sq Ft/Year)   Floor Area = 14,196 (Sq Ft)
Source Energy Consumption = 45,910 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

---------- U T I L I T Y   P E A K   C H E C K S U M S ----------

Utility ELECTRIC DEMAND

Peak Value 10.3 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total		0.0	0.00
Heating Equipment			
1	EQ2201 GAS FIRED UNIT HEATER	0.6	5.85
Sub Total		0.6	5.85
Sub Total		0.0	0.00
Sub Total		0.0	0.00
Miscellaneous			
Lights		9.7	94.15
Base Utilities		0.0	0.00
Misc Equipment		0.0	0.00
Sub Total		9.7	94.15
Grand Total		10.3	100.00

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**                    T R A C E   6 0 0   A N A L Y S I S                     **
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**                    by            **
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ESOS STUDY AT WSMR - BUILDING 1827
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO ⟨ECO#17⟩

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 6:41:52 1/21/92
Dataset Name: 1827 .TM

Tstat = 61°F

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr: 0/ 0				*	Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				*	OADB: 0		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-105,050	-105,050	27.39
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-16,475	-16,475	4.30
Wall Cond	0	0		0	0.00	*	0	0.00	*	-143,425	-143,425	37.39
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-18,037	-18,037	4.70
Infiltration	0			0	0.00	*	0	0.00	*	-100,586	-100,586	26.22
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-383,574	-383,574	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-383,574	-383,574	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	14,196		
Part	0		
ExFlr	650		
Roof	14,196	0	0
Wall	10,534	353	3

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-349.5	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-349.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	2,839
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-24.62

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1827

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Reheat Sensible (Btuh)	Reheat Airflow (Cfm)	Humidif. Sensible (Btuh)	Humidif. Airflow (Cfm)	Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
INFRARED HEATERS - 1827

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	Heating: System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1827

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Building		0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1827

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	14,196	14,196	0	650	0	0	14,196	353	3	10,180
Zone	1 Total/Ave.				14,196	0	650	0	0	14,196	353	3	10,180
System	1 Total/Ave.				14,196	0	650	0	0	14,196	353	3	10,180
Building					14,196	0	650	0	0	14,196	353	3	10,180

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-17,475	10	222	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-34,950	8	189	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-52,425	11	242	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-69,900	7	151	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-87,375	8	194	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-104,850	5	113	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-122,325	9	200	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-139,800	6	142	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-157,275	9	210	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-174,750	8	183	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-192,225	7	160	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-209,700	7	149	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-227,175	5	108	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-244,650	1	20	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-262,125	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-279,600	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-297,075	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-314,550	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-332,025	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-349,500	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,477	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	2,285	10	1,281	4
Feb	2,013	10	885	3
March	2,093	10	50	2
April	1,757	10	0	0
May	1,909	10	0	0
June	1,898	10	0	0
July	1,768	10	0	0
Aug	1,980	10	0	0
Sept	1,757	10	0	0
Oct	1,909	10	0	0
Nov	2,042	10	164	2
Dec	2,215	10	901	3
Total	23,627	10	3,281	4

Building Energy Consumption = 28,795 (Btu/Sq Ft/Year)   Floor Area = 14,196 (Sq Ft)
Source Energy Consumption = 29,510 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 10.3 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total	0.0	0.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.6	5.85
Sub Total	0.6	5.85
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	9.7	94.15
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	9.7	94.15
Grand Total	10.3	100.00

ESOS STUDY AT WSMR - BUILDING 1833
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Heating Only with Unit Heaters
One Room - High Bay Only.

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)
Design Simulation Period: May	To October	
System Simulation Period: January	To December	
Cooling Load Methodology:	TETD/Time Averaging	
Time/Date Program was Run:	14:21:33	1/19/92
Dataset Name:	1833 .TM	

Tstat = 65°

System 1 Block UH - UNIT HEATERS

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-23,122	-23,122	8.01
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-21,797	-21,797	7.55
Wall Cond	0	0		0	0.00	0	0.00	-128,821	-128,821	44.64
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-16,421	-16,421	5.69
Infiltration	0			0	0.00	0	0.00	-98,396	-98,396	34.10
Sub Total==>	0	0		0	0.00	0	0.00	-288,555	-288,555	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-288,555	-288,555	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	12,532		
Part	0		
ExFlr	534		
Roof	12,532	0	0
Wall	8,544	422	5

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-466.6	7,695	40.8	104.2
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-466.6			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	2,506
Supply	0	7,695
Mincfm	0	0
Return	0	7,695
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.61
Htg Btuh/SqFt	-37.23

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	104.2
Plenum	0.0	65.0
Return	0.0	65.0
Ret/OA	0.0	65.0
Runarnd	0.0	65.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1833

AIRFLOW HEATING LOADS
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Ventilation Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Reheat Airflow (Cfm)	Reheat Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1833

AIRFLOW HEAT GAIN AND LOSS
(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	7,695
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	7,695
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	7,695
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	7,695
System	1 Block	0	0	0	0	0	0	0	0	0	0	7,695

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1833

BUILDING U-VALUES

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Building		0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1833

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,532	12,532	0	534	0	0	12,532	422	5	8,122
Zone	1 Total/Ave.				12,532	0	534	0	0	12,532	422	5	8,122
System	1 Total/Ave.				12,532	0	534	0	0	12,532	422	5	8,122
Building					12,532	0	534	0	0	12,532	422	5	8,122

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-23,328	10	240	384.7	0	0	0.0	0	0
5 - 10	0.0	0	0	-46,656	23	565	769.5	0	0	0.0	0	0
10 - 15	0.0	0	0	-69,984	14	334	1,154.2	0	0	0.0	0	0
15 - 20	0.0	0	0	-93,312	20	503	1,539.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-116,640	15	380	1,923.7	0	0	0.0	0	0
25 - 30	0.0	0	0	-139,968	10	243	2,308.5	0	0	0.0	0	0
30 - 35	0.0	0	0	-163,296	8	197	2,693.3	0	0	0.0	0	0
35 - 40	0.0	0	0	-186,624	0	0	3,078.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-209,952	0	0	3,462.8	0	0	0.0	0	0
45 - 50	0.0	0	0	-233,280	0	0	3,847.5	0	0	0.0	0	0
50 - 55	0.0	0	0	-256,608	0	0	4,232.3	0	0	0.0	0	0
55 - 60	0.0	0	0	-279,936	0	0	4,617.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-303,264	0	0	5,001.8	0	0	0.0	0	0
65 - 70	0.0	0	0	-326,592	0	0	5,386.5	0	0	0.0	0	0
70 - 75	0.0	0	0	-349,920	0	0	5,771.3	0	0	0.0	0	0
75 - 80	0.0	0	0	-373,248	0	0	6,156.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-396,576	0	0	6,540.8	0	0	0.0	0	0
85 - 90	0.0	0	0	-419,904	0	0	6,925.5	0	0	0.0	0	0
90 - 95	0.0	0	0	-443,232	0	0	7,310.3	0	0	0.0	0	0
95 - 100	0.0	0	0	-466,560	0	0	7,695.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,298	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,271	16	1,048	3
Feb	2,958	16	785	3
March	3,246	16	104	2
April	2,805	15	0	0
May	3,049	15	0	0
June	3,030	15	0	0
July	2,824	15	0	0
Aug	3,161	15	0	0
Sept	2,805	15	0	0
Oct	3,049	15	0	0
Nov	3,042	16	164	2
Dec	3,159	16	750	3
Total	36,401	16	2,851	3

Building Energy Consumption = 32,664 (Btu/Sq Ft/Year)   Floor Area = 12,532 (Sq Ft)

Source Energy Consumption = 33,368 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 15.9 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total	0.0	0.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.4	2.84
Sub Total	0.4	2.84
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	15.4	97.16
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	15.4	97.16
Grand Total	15.9	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                          **
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**              by          **
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ESOS STUDY AT WSMR - BUILDING 1833
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO #17)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 7: 0:33 1/21/92
Dataset Name: 1833 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-20,866	-20,866	8.01
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-19,679	-19,679	7.56
Wall Cond	0	0		0	0.00	0	0.00	-116,253	-116,253	44.64
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-14,819	-14,819	5.69
Infiltration	0			0	0.00	0	0.00	-88,796	-88,796	34.10
Sub Total==>	0	0		0	0.00	0	0.00	-260,412	-260,412	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-260,412	-260,412	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	12,532		
Part	0		
ExFlr	534		
Roof	12,532	0	0
Wall	8,544	422	5

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-247.5	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-247.5			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	0	2,506
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-19.75

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	61.1
Plenum	0.0	61.0
Return	0.0	61.0
Ret/OA	0.0	61.0
Runarnd	0.0	61.0
Fn MtrTD	0.0	0.1
Fn BldTD	0.0	0.1
Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1833

A I R F L O W   H E A T I N G   L O A D S
(At time of Coil Peak)

Room Number	Description	Ventilation Airflow (Cfm)	Op. Vent. Sensible (Btuh)	Op. Vent. Airflow (Cfm)	Reheat Sensible (Btuh)	Reheat Airflow (Cfm)	Humidif. Sensible (Btuh)	Humidif. Airflow (Cfm)	Humidif. Latent (Btuh)	Total (Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2
INFRARED HEATERS - 1833

A I R F L O W   H E A T   G A I N   A N D   L O S S
(At time of Coil Peak)

Room Number	Description	Heating: Supply Fan Heat (Btuh)	Return Fan Heat (Btuh)	System Exhaust Heat Loss (Btuh)	Total (Btuh)	System Exhaust Airflow (Cfm)	Room Exhaust Airflow (Cfm)	Ducted Airflow (Cfm)	Plenum Airflow (Cfm)	Run Around Airflow (Cfm)	Corridr Airflow (Cfm)	System Return Airflow (Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1833

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F): Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Building		0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1833

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,532	12,532	0	534	0	0	12,532	422	5	8,122
Zone	1 Total/Ave.				12,532	0	534	0	0	12,532	422	5	8,122
System	1 Total/Ave.				12,532	0	534	0	0	12,532	422	5	8,122
Building					12,532	0	534	0	0	12,532	422	5	8,122

↕

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	0.0	0	0	-12,375	9	172	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-24,750	14	268	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-37,125	9	181	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-49,500	8	153	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-61,875	10	189	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-74,250	11	219	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-86,625	7	135	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-99,000	12	241	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-111,375	8	153	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-123,750	6	128	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-136,125	5	89	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-148,500	2	49	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-160,875	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-173,250	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-185,625	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-198,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-210,375	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-222,750	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-235,125	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-247,500	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,783	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	3,271	16	703	2
Feb	2,951	16	475	2
March	3,176	16	12	1
April	2,805	15	0	0
May	3,049	15	0	0
June	3,030	15	0	0
July	2,824	15	0	0
Aug	3,161	15	0	0
Sept	2,805	15	0	0
Oct	3,049	15	0	0
Nov	2,863	16	47	1
Dec	3,078	16	453	2
Total	36,064	16	1,691	2

Building Energy Consumption = 23,312 (Btu/Sq Ft/Year) Floor Area = 12,532 (Sq Ft)
Source Energy Consumption = 23,729 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

--------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S ---------------------------------------

Utility ELECTRIC DEMAND

Peak Value 15.9 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

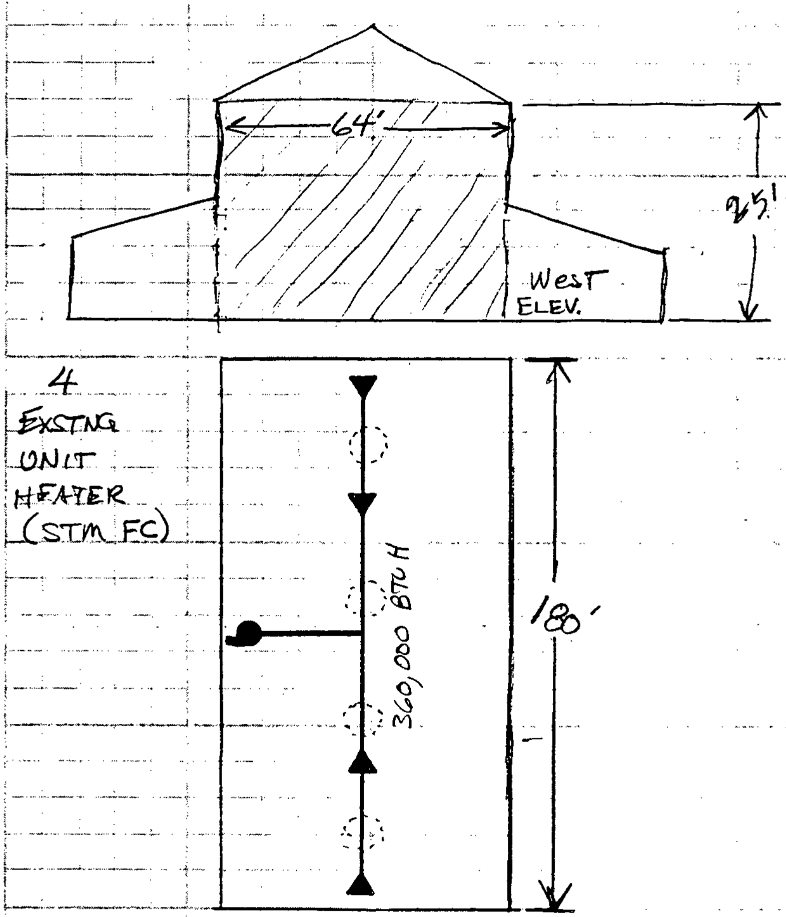
Hour 9 Month 1

Sub Total		0.0	0.00
Heating Equipment			
1 EQ2201	GAS FIRED UNIT HEATER	0.4	2.84
Sub Total		0.4	2.84
Sub Total		0.0	0.00
Sub Total		0.0	0.00
Miscellaneous			
Lights		15.4	97.16
Base Utilities		0.0	0.00
Misc Equipment		0.0	0.00
Sub Total		15.4	97.16
Grand Total		15.9	100.00

ECO #17: Replace Unit Heaters W/ Infrared Heaters (N.G.)

JOB # 1110-000 PROJECT: WSMR ESOS
BY: AJN DATE: CK BY: DATE: 8 June 1992
PAGE 1 OF 5

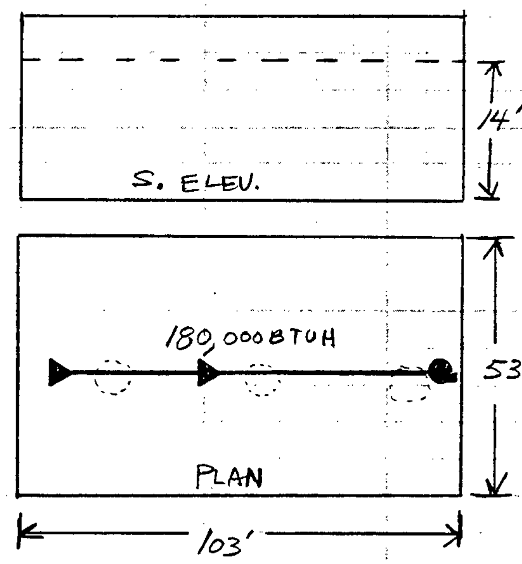
BLDG. 1550 & 1554



TRACE 600
DESIGN HTG LOAD = 303,350 BTUH

Install E-Series System: CRV-E360 at 360,000 BTUH

BLDG. 1644



3 EXSTNG UNIT HEATERS (HW FC)

TRACE 600
DESIGN HTG LOAD = 144,000 BTUH

Install E-Series System: CRV-E180 at 180,000 BTUH

LEGEND

▶ = Gas Burner
● = Vacuum Pump
◌ = EXISTING FAN COIL

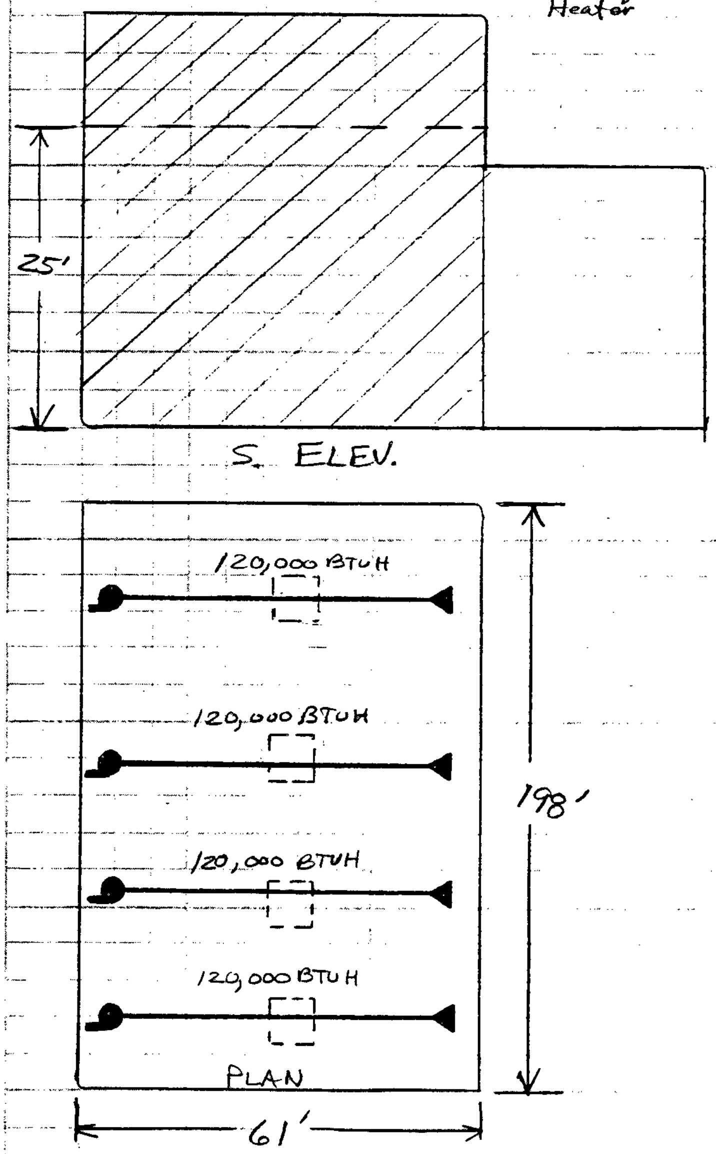
EMC

ECO #17 (CONT')

JOB # 1110-000 PROJECT: WSMR ESOS
BY: AJN DATE: CK BY: DATE: 8 June 1992
PAGE 2 OF 5

LEGEND
▶ = Gas Burner
= Vacuum Pump
[ ] = Existing Unit Heater

BLDG. 1680

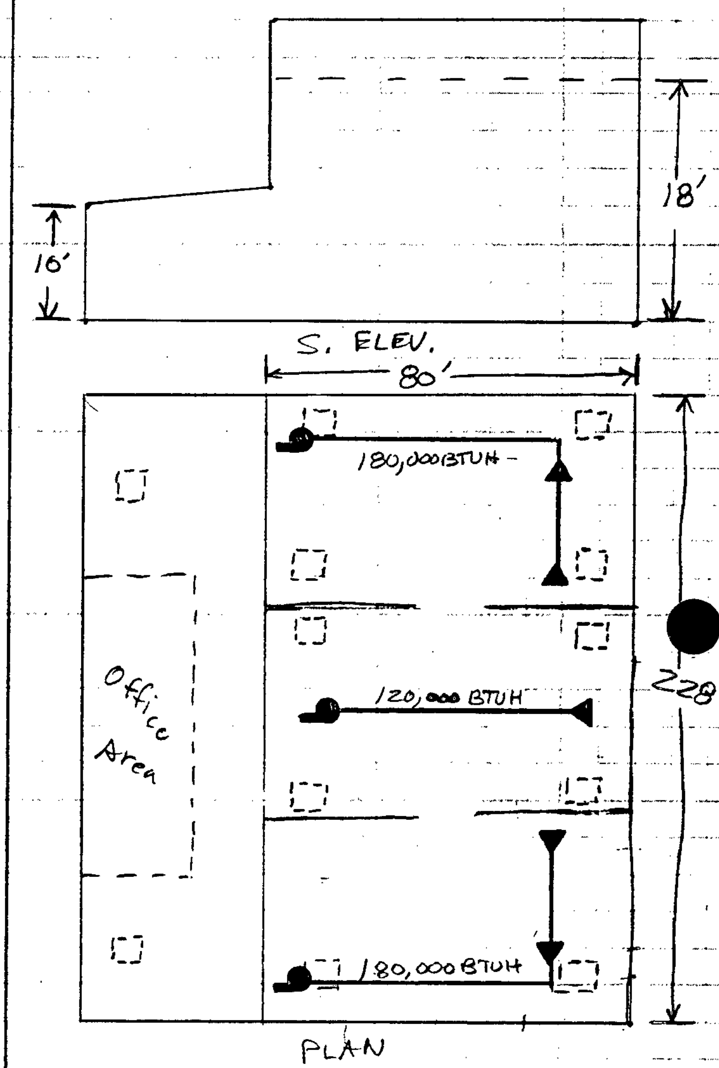


4 unit heaters (EXISTING)

TRACE 600
DESIGN HTG LOAD = 482,630 BTUH

Install E-Series System: 4 - CRV-E120 at 120,000 BTUH ea

BLDG. 1751



12 unit heaters (N.G.) (EXISTING)

TRACE 600
DESIGN HTG LOAD = 426,150 BTUH

Install E-Series System:
2 - CRV-E180 at 180,000 BTUH ea.
1 - CRV-E120 at 120,000 BTUH ea.

ECO #17 (CONT')

LEGEND

▶ = Gas Burner

● = Vacuum Pump

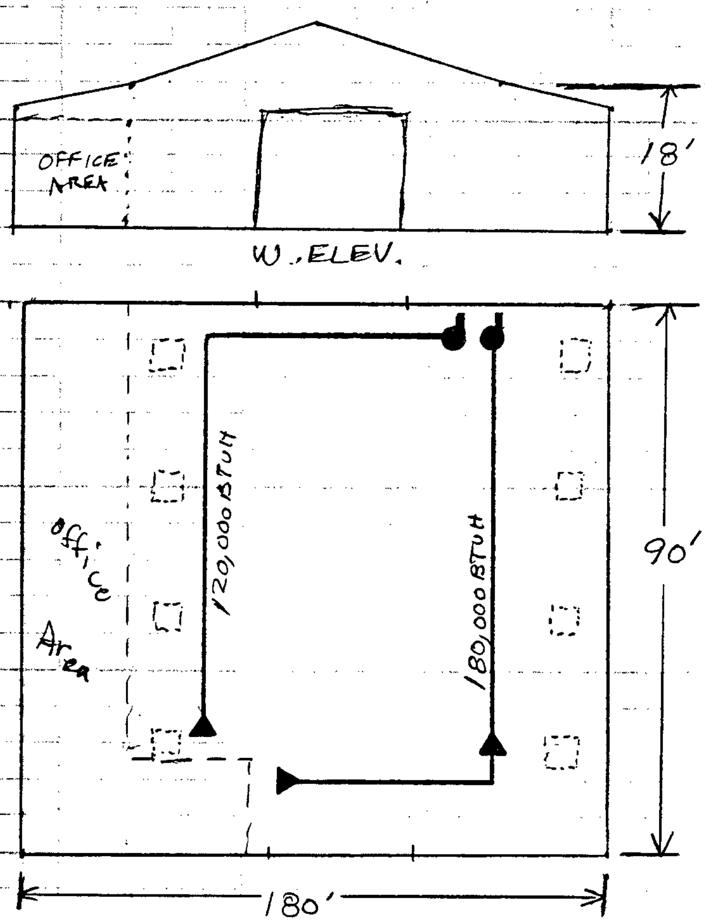
⬚ = Existing Unit Heater

JOB # 1110-000 PROJECT: WSMR ESOS

BY: AJN DATE: CK BY: DATE:

PAGE 3 OF 5 8 June 1992

BLDG. 1753



PLAN

8 UNIT HEATERS (EXISTING)

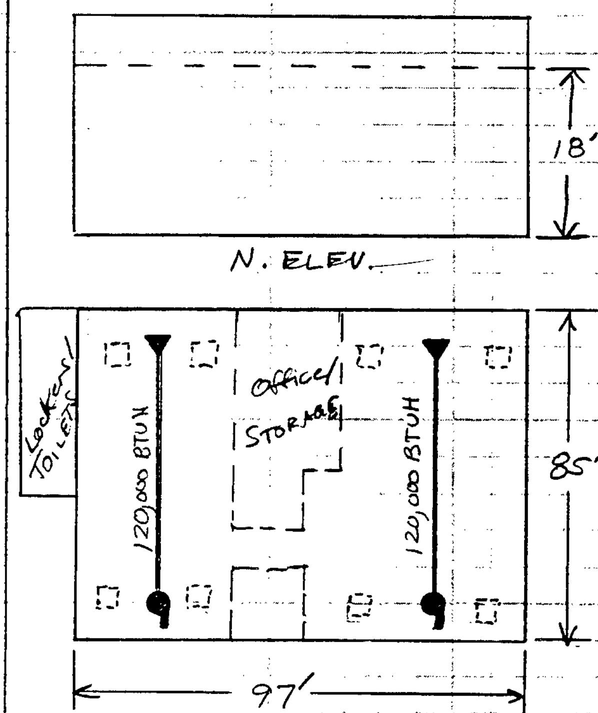
TRACE 600

DESIGN HTG LOAD = 267,380 BTUH

Install E-Series System: 1 - CRV-E120 at 120,000 BTUH

1 - CRV-E180 at 180,000 BTUH

BLDG. 1788



PLAN

8 UNIT HEATERS (EXISTING)

TRACE 600

DESIGN HTG LOAD = 227,750 BTUH

Install E-Series System:

2 - CRV-E120 at 120,000 BTUH (ea)

EMC

ECO #17 (CONT.')

JOB# 1110-000 PROJECT: WSMR ESOS
BY: AJN DATE: CK BY: DATE: 8 June
PAGE 4 OF 5

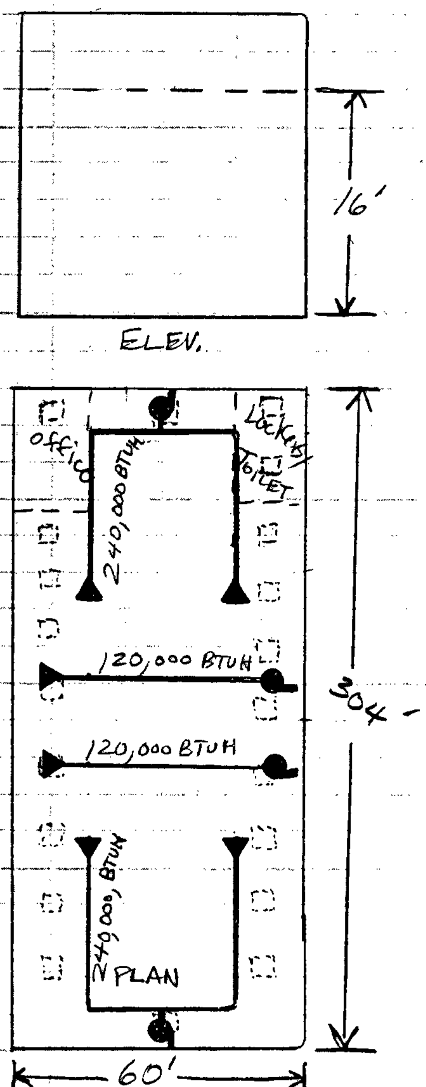
LEGEND

▶ = Gas Burner

● = Vacuum Pump

⬚ = Existing Unit Heater

BLDG. 1794

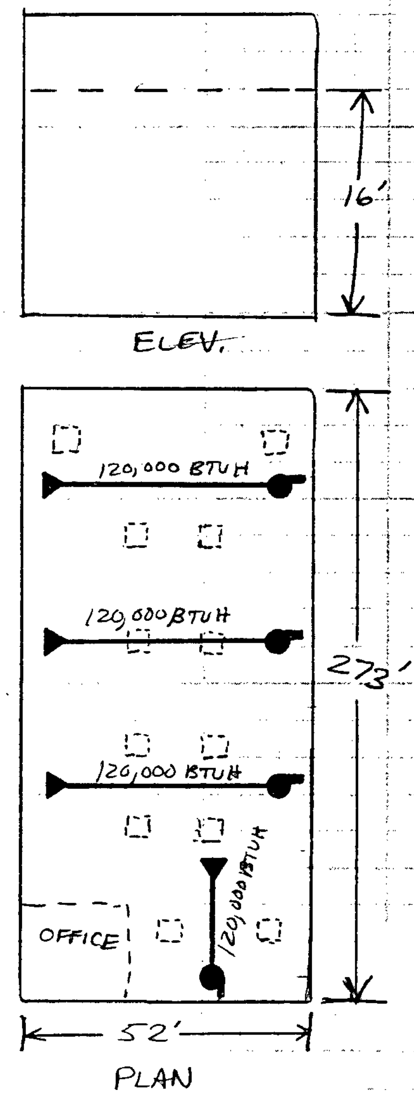


21 UNIT HEATERS (EXISTING)

TRACE 600
DESIGN HTG LOAD = 660,000 BTUH

Install E-Series System:
2 - CRV-E120 at 120,000 BTUH @
2 - CRV-E240 at 240,000 BTUH @

BLDGS. 1827



12 UNIT HEATERS 383,574

TRACE 600
DESIGN HTG LOAD = 383,600 BTUH

Install E-Series System:
4 - CRV-E 120 at 120,000 BTUH @

ECO #17 (CONT.)

JOB # 1110-000 PROJECT: WSMR ESOS
BY: AJN DATE: CK BY: DATE: 8 June 1992
PAGE 5 OF 5

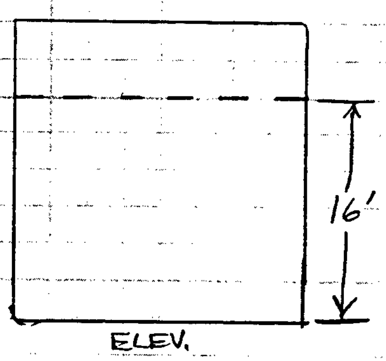
BLDG. 1833

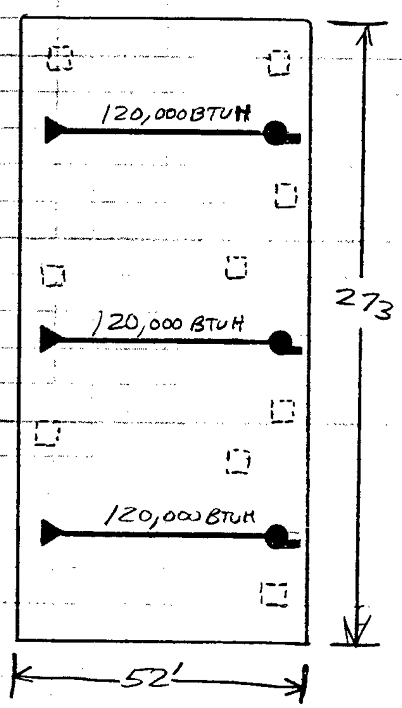
LEGEND

▶ = Gas Burner

● = Vacuum Pump

□ = Existing Unit Heaters





9 UNIT HEATERS.

TRACE 600

DESIGN HTG LOAD = 260,500 BTUH

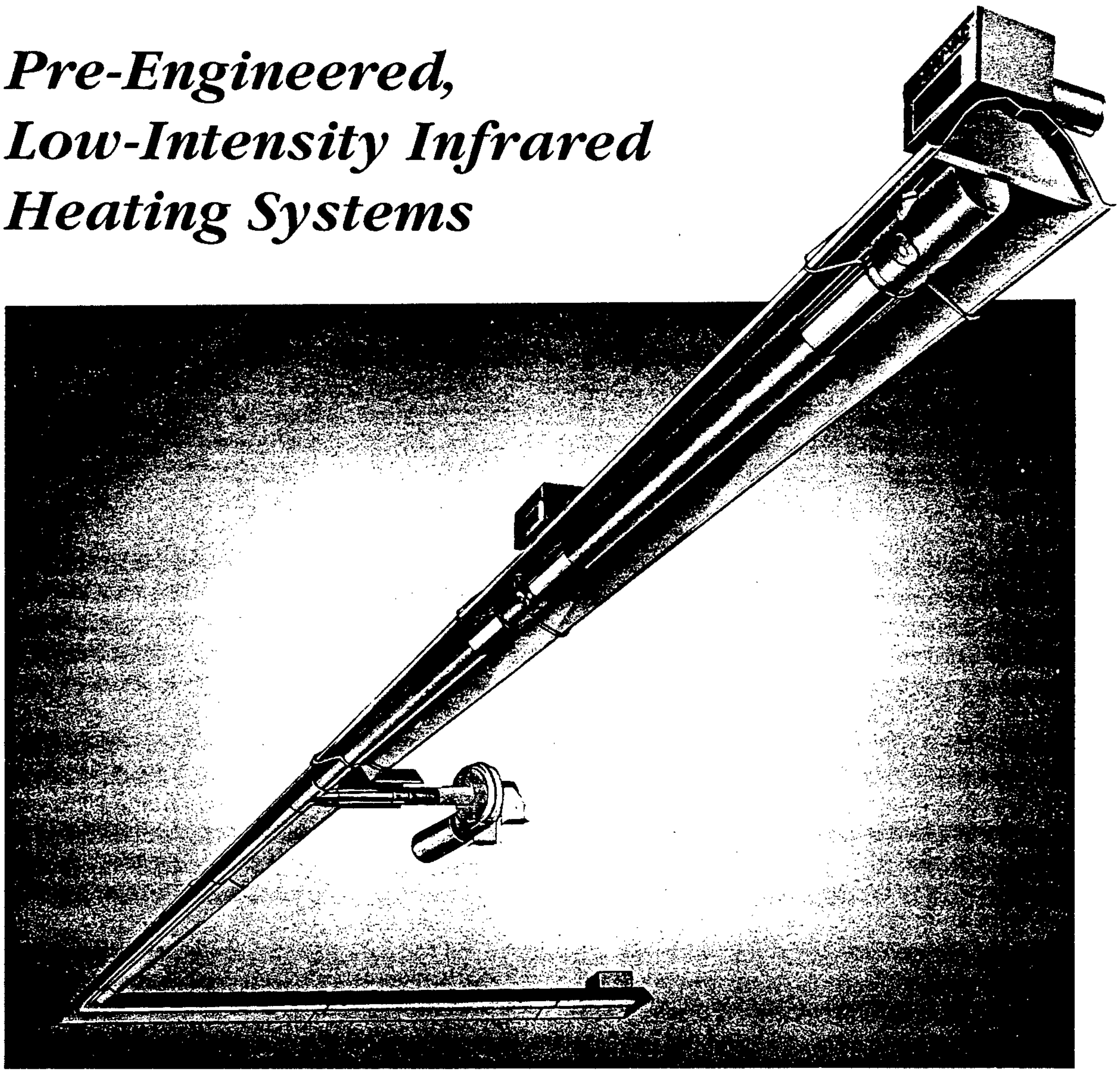
Install E-Series System:

3 - CRV-E120 at 120,000 BTUH @

EMC

E SERIES

Pre-Engineered, Low-Intensity Infrared Heating Systems



Roberts-Gordon, Inc.

Energy Efficient Comfort.

D6-175

E SERIES
Pre-Engineered Systems Are Practical and Energy-Saving.

Reduce Fuel Costs and Improve Comfort

E Series systems combine the latest in gas combustion technology with the principles of infrared energy to provide an efficient and economical way to heat. Users report that Roberts-Gordon gas-fired infrared heating equipment dramatically improves worker comfort and slashes fuel bills up to 50% and more!

Competitive Cost...Easy to Install and Maintain

E Series is pre-engineered to reduce design costs and simplify installation. E Series systems are built to provide years of economical operation and trouble-free service.

Design Flexibility

E Series systems are available in five practical models with system inputs ranging from 120,000 through 360,000 BTU/Hr. These basic models offer many different variations in design configurations to fit a wide variety of building layouts and areas to be heated.

Complete Product Line

E Series is part of the broadest product line of low-intensity infrared heating equipment in North America. Roberts-Gordon gas-fired radiant heating equipment also includes custom-engineered Co-Ray-Vac condensing vacuum systems and economy-priced, vacuum-vented EconoVac systems plus Vantage II and Gordon-Ray unitary heaters.

Reliability and Expertise

Roberts-Gordon pioneered low-intensity infrared heating systems in the late 1950's and continues to maintain leadership in the industry. Backed by a three-year limited warranty, each E Series system is built to uphold the well-established Roberts-Gordon standards of engineering excellence, efficiency and reliability.

Applications Include:

- Aircraft Hangars
- Automotive Facilities
- Warehouses
- Manufacturing Facilities
- Fire Stations
- Agricultural Buildings
- Recreational Facilities
- Machine Shops
- Vehicle Maintenance Buildings

System Features:

- Pre-engineered heat exchanger tube lengths.
- System capacities of 120,000; 180,000; 240,000; 300,000 and 360,000 BTU/Hr.
- Two burners can fire in series in one branch to provide more uniform comfort.
- One or two branches can be connected to one treated steel, 1/3-hp vacuum pump.
- Vacuum-assisted system. Negative or varying ambient pressure does not affect operation. No leakage of flue gases or products of combustion into the building.
- Safety vacuum switch prevents energization of burners in the event of motor failure.
- Single or dual zone temperature control for multi-branch systems.
- Extensive use of corrosion resistant materials.
- Weight-saving construction to ease installation.
- Clean, quiet, draft-free heat.
- Three-year limited warranty on all components.
- A.G.A. design certified.

E SERIES BASIC SYSTEMS

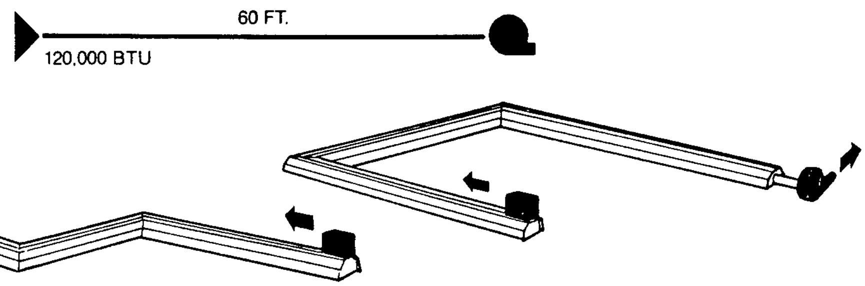
The five E Series basic systems can be modified to fit a wide variety of floor plans and heating needs. Shown in each box below are a schematic of each E Series basic system plus illustrations of two design configurations. Many more configurations are possible.

E Series Basic Systems Schematics

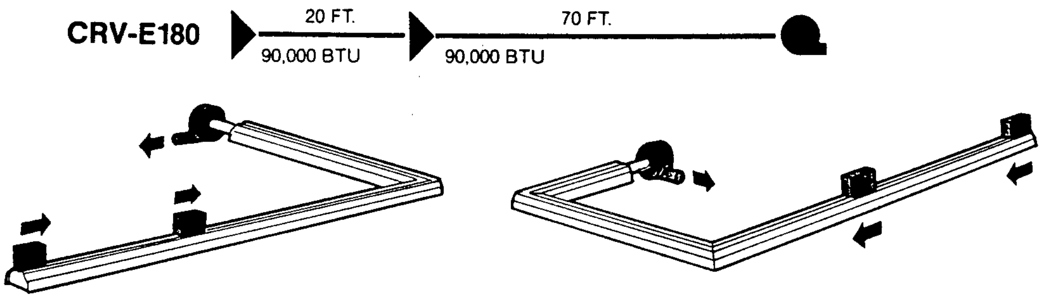
Legend: ▶ = Burner ● = Vacuum Pump

Note: Diagrams are not shown to scale.

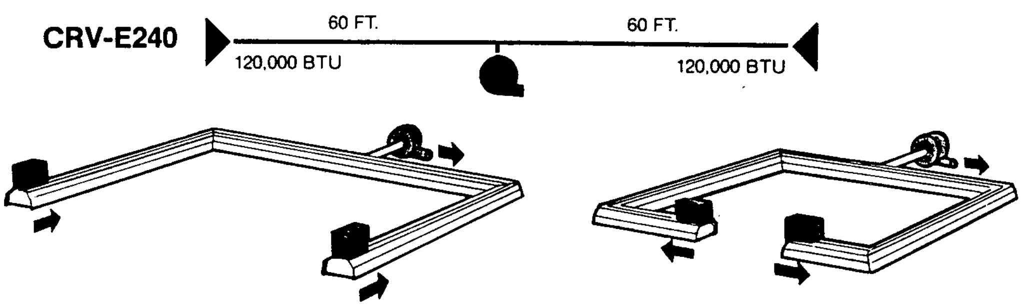
CRV-E120



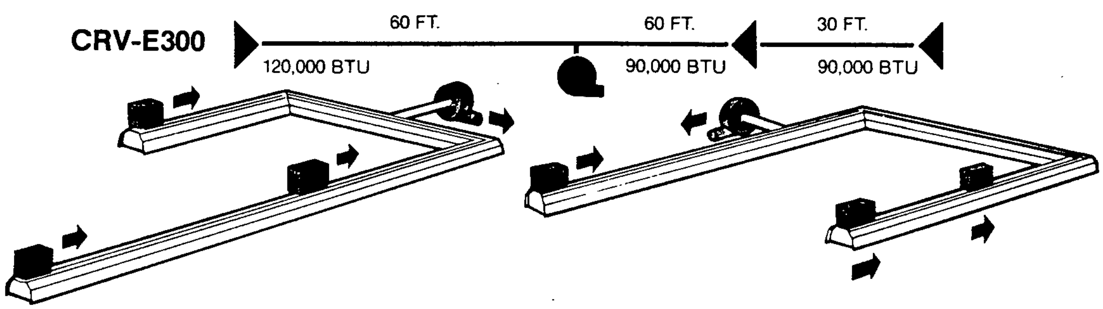
CRV-E180



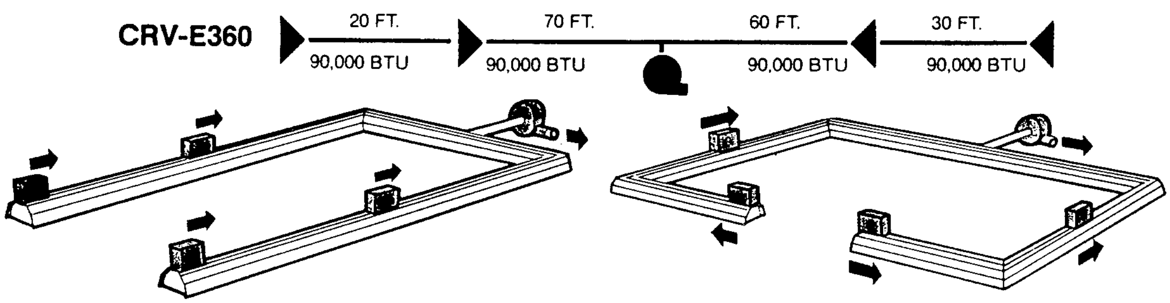
CRV-E240



CRV-E300

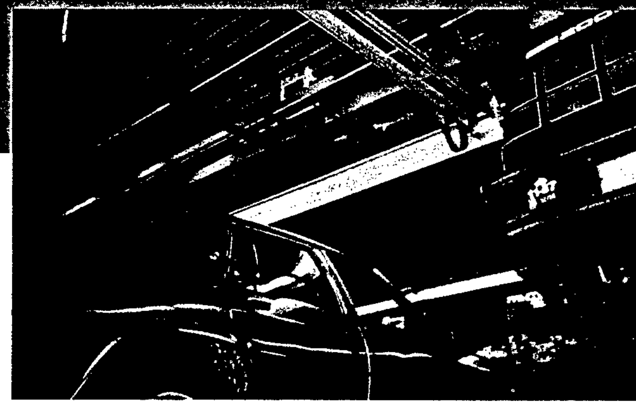


CRV-E360

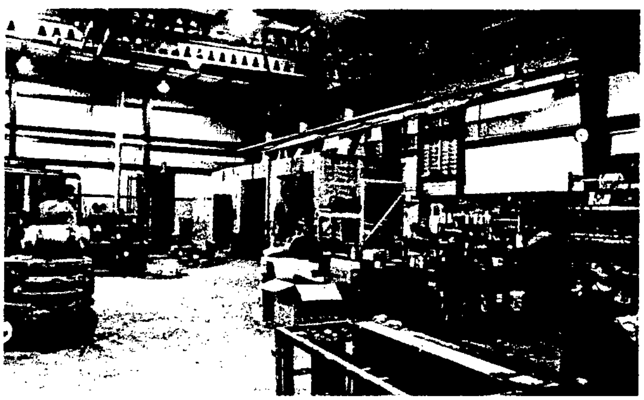


Typical E SERIES Installations

Workers are more comfortable at lower thermostat settings because E Series systems heat the floor, people and objects directly. This enables users to cut fuel bills significantly.



E Series systems provide clean, quiet, draft-free heat. They are ideal for automotive and manufacturing facilities because, unlike forced-air heaters, E Series systems do not spread dirt, grit or dust.



Optional side reflector extensions on this E Series system reflect radiant energy toward the middle of the shop where it is needed.

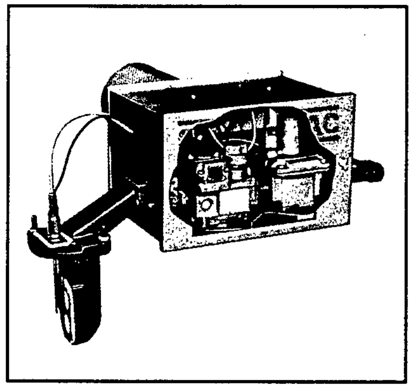
E Series radiant heat melts snow and ice off vehicles to shorten return-to-service time. In addition, floors are kept warm and act as heat reservoirs to provide rapid heat recovery when bay doors are used.

E Series systems are available in several pre-engineered packages that can be customized to meet individual floor plans and areas to be heated.

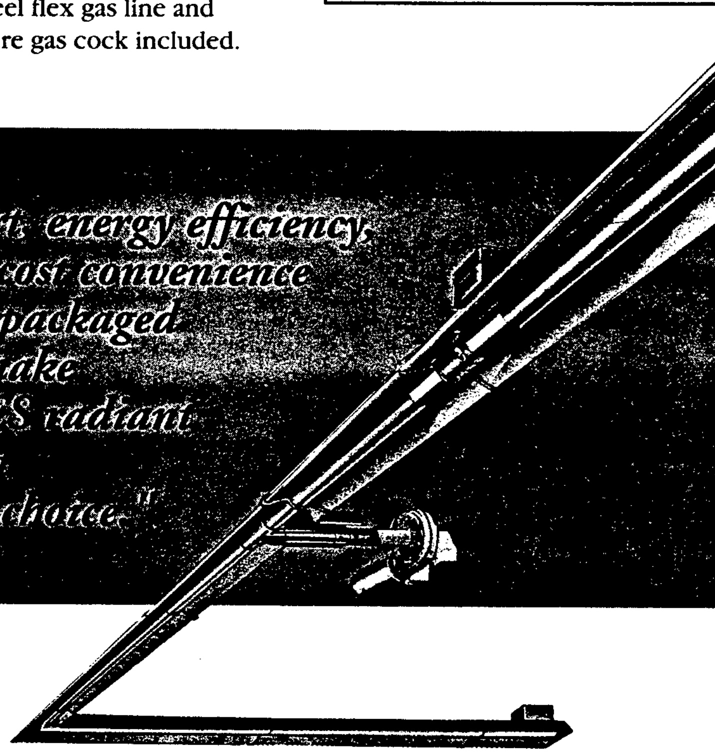
The capability of isolated combustion allows E Series systems to operate in hostile environments, such as this manufacturing facility in which halogenated hydrocarbons are present.

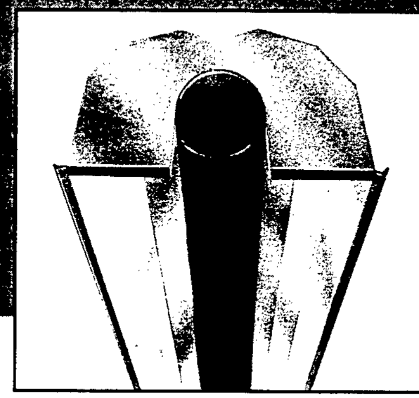
Burners:

- 90,000 and 120,000 BTU/Hr. inputs available.
- Natural gas and L.P. models available.
- Three-try direct spark ignition (D.S.I.).
- Constant regulation of air-to-gas ratio to achieve best mixture.
- Pre-purge capability standard.
- Filtered combustion air.
- Cast-iron head; nickel plating optional.
- Mica flame observation window.
- Stainless steel flex gas line and high pressure gas cock included.



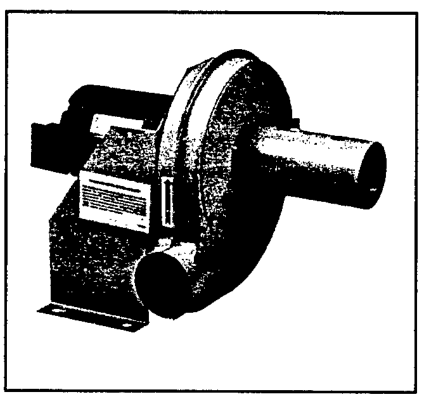
"Comfort, energy efficiency, and the cost convenience of a pre-packaged system make E SERIES radiant heaters a popular choice."





Tube and Reflector:

- 4" diameter 16-gauge tubing, hot rolled and aluminized steel (all aluminized steel option).
- Quick assembly stainless steel couplings.
- Unique deep-dish aluminum reflectors maximize radiant effect to the floor.
- End caps included.
- Nickel plated hangers.
- Chrome plated hardware.
- Side reflector option.
- Decorative grille option.



Vacuum Pump:

- 1/3-hp TENV
- Capacitor start
- Single phase
- Ball bearing
- Thermally-protected
- Life-lubricated bearings

E SERIES

CRV-E SERIES SPECIFICATIONS

FLUE CONNECTION	GAS CONNECTION	ELECTRICAL RATING	TUBE DIAMETER	IGNITION SYSTEM	MIN. GAS INLET PRES.
4" O.D.	1/2" NPT	115 VAC, 60 Hz. Burner: .30 amp each Vacuum Pump: 7.2 amp	4"	Direct spark (Three-try with pre-purge)	Natural 4.5" W.C. L.P. 10.5" W.C.

BASIC SYSTEMS

Model #	Number of Burners		Total BTU/Hr.	Total Length of Tube
	E9 (90,000 BTU/Hr.)	E12 (120,000 BTU/Hr.)		
CRV-E120	–	1	120,000	60'
CRV-E180	2	–	180,000	90'
CRV-E240	–	2	240,000	120'
CRV-E300	2	1	300,000	150'
CRV-E360	4	–	360,000	180'

CLEARANCES TO COMBUSTIBLES*

	FIGURE 1				FIGURE 2				FIGURE 3			
BURNER	A	B	C	D	A	B	C	D	A	B	C	D
E9	4"	20"	40"	20"	4"	12"	46"	24"	4"	12"	46"	12"
E12	4"	24"	48"	24"	4"	12"	54"	34"	4"	12"	54"	12"

* See installation manual for complete information.

Reflector
Horizontal

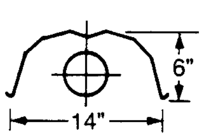


Figure 1
Standard
Reflector

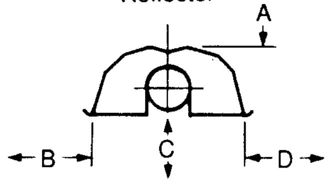


Figure 2
One Side
Extension

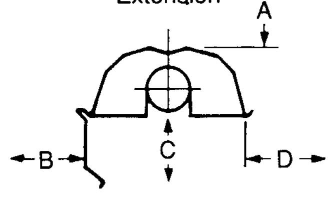
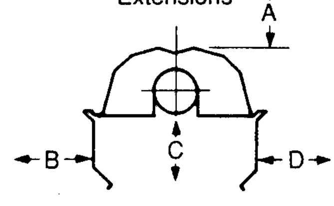


Figure 3
Two Side
Extensions



Roberts-Gordon, Inc.
Subsidiary of A.J. Industries, Inc.
P.O. Box 44 • Buffalo, NY 14240-0044
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D6-180

F2271 Rev. 6/91 5M BL

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LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range | REGION: 4 | PROJECT NO: DACA 63-91-C-0152

PROJECT TITLE: ECO #19 & #20 – BLDG. 100 – MODIFY HEATING CONTROLS | FISCAL YEAR: 1992

DISCRETE PORTION NAME: TOTAL

ANALYSIS DATE: 06/15/92 | ECONOMIC LIFE: 15 | PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$12,071	
B. SIOH COST		(5.5% of 1A) =	$664	
C. DESIGN COST		(6.0% of 1A) =	$724	
D. ENERGY CREDIT		(1A + 1B + 1C) =	$13,460	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT		(1D – 1E) =	————>	$13,460

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	14	$256	10.79	$2,762	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	826	$1,826	12.38	$22,610	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		839	2,082.3		————>	$25,372

3 NON–ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–)	=		$0	
1 DISCOUNT FACTOR	(From Table A–2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$0	

B. NON–RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON–ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$0
D. PROJECT NON–ENERGY TEST			
1 25% MAXIMUM NON–ENERGY CALCULATION	(2F5 x 0.33) =	$8,373	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$2,082
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$25,372
6 DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.89
7 SIMPLE PAYBACK (SPB)	(1F/4) =	6.46

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range　　REGION: 4　　PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: ECO #19 & #20 - BLDG. 124 - MODIFY HEATING CONTROLS　　FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/15/92　　ECONOMIC LIFE: 15　　PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$5,191	
B. SIOH COST	(5.5% of 1A) =		$286	
C. DESIGN COST	(6.0% of 1A) =		$311	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$5,788	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		---------->	$5,788

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	8	$142	10.79	$1,536	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	740	$1,636	12.38	$20,257	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		747	1,778.6		---------->	$21,793

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$7,192	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$1,779
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$21,793
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	3.77
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	3.25

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): RADIANT HEATING SYSTEMS – BLDGS 100 & 124

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	BUILDING NO. 100									
	THERMOSTATIC CONTROL VALVES WITH WALL THERMOSTATS	EA	119	73.81	8783.39	119.00	27.63	3287.97		$12,071.36
	TOTAL FOR BLDG. 100									$12,071.36
2	BUILDING NO. 124									
	3" 3-WAY MIXING VALVE	EA	1	2735.30	2735.30	4.00	35.81	143.24		$2,878.54
	HOT WATER RESET CONTROLLER	EA	2	375.00	750.00	4.00	35.81	143.24		$893.24
	THERMOSTATS & WIRING	EA	6	62.50	375.00	12.00	35.81	429.72		$804.72
	LOW VOLTAGE TRANSFORMER	EA	1	71.25	71.25	2.00	35.81	71.62		$142.87
	SUBTOTAL FOR BLDG. 124									$4,719.37
	CONTINGENCY (10%)									$471.94
	TOTAL FOR BLDG. 124									$5,191.31

Material Source: M.P.D. Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

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**                                                                          **
**               T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                          **
**               by           **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 100
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
MODIFY HTG CONTROLS ECO#20

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 19:50: 7 1/23/92
Dataset Name: 100A .TM

System 1 Block RAD - RADIATION

************************** COOLING COIL PEAK ********************************** CLG SPACE PEAK ************ HEATING COIL PEAK *****

Peaked at Time ==>		Mo/Hr: 0/ 0				Mo/Hr: 0/ 0			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				OADB: 0			OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-85,787	-85,787	8.96
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-192,847	-192,847	20.15
Wall Cond	0	0		0	0.00	0	0.00	-360,018	-360,018	37.62
Partition	0			0	0.00	0	0.00	-2,526	-2,526	0.26
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-315,737	-315,737	33.00
Sub Total==>	0	0		0	0.00	0	0.00	-956,916	-956,916	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-956,916	-956,916	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	30,722		
Part	22,258		
ExFlr	0		
Roof	15,572	0	0
Wall	22,789	3,330	15

------------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,273.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,273.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	7,168
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-41.44

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	70.1
Plenum	0.0	70.0
Return	0.0	70.0
Ret/OA	0.0	70.0
Runarnd	0.0	70.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak	Clg Space Peak	Heating Coil Peak
Peaked at Time ==>	Mo/Hr: 8/16	Mo/Hr: 8/16	Mo/Hr: 0/ 0
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0	OADB: 96	OADB: 0

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	14,496	0		14,496	26.59	14,496	29.25	0	0	0.00
Glass Cond	5,990	0		5,990	10.99	5,990	12.09	0	0	0.00
Wall Cond	19,625	0		19,625	36.00	19,625	39.61	0	0	0.00
Partition	-1,945			-1,945	-3.57	-1,945	-3.93	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	38,166	0		38,166	70.02	38,166	77.02	0	0	0.00
Internal Loads										
Lights	28,409	0		28,409	52.12	28,409	57.33	0	0	0.00
People	4,200			4,200	7.71	2,300	4.64	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	32,609	0	0	32,609	59.83	30,709	61.97	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	656	1.20	0	0.00	0	0	0.00
Sup. Fan Heat				2,400	4.40		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	-19,324			-19,324	-35.45	-19,324	-39.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	51,451	0	0	54,506	100.00	49,551	100.00	0	0	0.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	5.0	60.0	58.2	2,250	78.4	59.3	57.2	53.9	48.9	51.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	3,784		
Part	838		
ExFlr	0		
Roof	0	0	0
Wall	2,884	302	10

-----------HEATING COIL SELECTION-----------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,250	0.6	53.9
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	56	0
Infil	0	0
Supply	2,250	0
Mincfm	0	0
Return	2,250	0
Exhaust	56	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	2.5
Clg Cfm/Sqft	0.59
Clg Cfm/Ton	450.00
Clg Sqft/Ton	756.70
Clg Btuh/Sqft	15.86
No. People	10
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	78.4	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.8	11	378	-63,650	22	628	332.5	0	0	0.0	0	0
5 - 10	1.6	11	364	-127,300	19	557	665.0	0	0	0.0	0	0
10 - 15	2.4	9	291	-190,950	11	305	997.5	0	0	0.0	0	0
15 - 20	3.2	8	287	-254,600	11	325	1,330.0	0	0	0.0	0	0
20 - 25	4.0	7	247	-318,250	14	395	1,662.5	0	0	0.0	0	0
25 - 30	4.8	8	282	-381,900	11	304	1,995.0	0	0	0.0	0	0
30 - 35	5.6	7	242	-445,550	7	196	2,327.5	1	49	0.0	0	0
35 - 40	6.4	8	287	-509,200	5	150	2,660.0	0	0	0.0	0	0
40 - 45	7.2	8	262	-572,850	0	0	2,992.5	0	0	0.0	0	0
45 - 50	8.0	9	291	-636,500	0	0	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	150	-700,150	0	0	3,657.5	0	0	0.0	0	0
55 - 60	9.6	3	108	-763,800	0	0	3,990.0	0	0	0.0	0	0
60 - 65	10.4	4	151	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	2	63	-891,100	0	0	4,655.0	12	436	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	0
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	0
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 95	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	86	3,079	0.0	0	0
Hours Off	0.0	0	5,357	0	0	5,900	0.0	0	5,196	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	19,290	87	2,983	11
Feb	17,441	87	2,273	10
March	19,848	87	549	6
April	15,087	107	3	1
May	29,045	143	0	0
June	37,700	146	0	0
July	39,990	146	0	0
Aug	39,532	146	0	0
Sept	28,311	141	0	0
Oct	19,789	138	0	0
Nov	18,380	87	675	5
Dec	18,690	87	2,101	9
Total	303,102	146	8,584	11

Building Energy Consumption = 61,615 (Btu/Sq Ft/Year)   Floor Area = 30,722 (Sq Ft)
Source Energy Consumption = 62,479 (Btu/Sq Ft/Year)

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**                                                                         **
**                   T R A C E   6 0 0   A N A L Y S I S                   **
**                                                                         **
**                   by              **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 124
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
MODIFY HTG CONTROLS: ALT 1-BSLN,ALT2-ECO (ECO#20)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 1:43:17 1/24/92
Dataset Name: 124A .TM

System 1 Block RAD - RADIATION

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-62,015	-62,015	6.36
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	-368,581	-368,581	37.81
Wall Cond	0	0		0	0.00	0	0.00	-196,698	-196,698	20.18
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	-347,648	-347,648	35.66
Sub Total==>	0	0		0	0.00	0	0.00	-974,942	-974,942	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-974,942	-974,942	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	40,046		
Part	18,194		
ExFlr	0		
Roof	13,348	0	0
Wall	22,202	6,365	29

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,798.4	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,798.4			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	7,893
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-44.91

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	70.1
Plenum	0.0	70.0
Return	0.0	70.0
Ret/OA	0.0	70.0
Runarnd	0.0	70.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 0/ 0
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 0

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	11,664	0		11,664	22.99	11,664	25.38	0	0	0.00
Glass Cond	9,456	0		9,456	18.63	9,456	20.57	0	0	0.00
Wall Cond	6,579	0		6,579	12.97	6,579	14.31	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	27,698	0		27,698	54.59	27,698	60.27	0	0	0.00
Internal Loads										
Lights	10,614	0		10,614	20.92	10,614	23.09	0	0	0.00
People	2,100			2,100	4.14	1,150	2.50	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	12,714	0	0	12,714	25.06	11,764	25.60	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	3,120	6.15	0	0.00	0	0	0.00
Sup. Fan Heat				711	1.40		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	6,497			6,497	12.80	6,497	14.14	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	46,910	0	0	50,742	100.00	45,960	100.00	0	0	0.00

---------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	5.0	60.0	59.5	2,000	80.0	58.9	52.5	53.8	46.9	44.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	5.0	60.0								

-------------AREAS-------------

Gross Total		Glass (sf)	(%)
Floor	1,555		
Part	0		
ExFlr	0		
Roof	0	0	0
Wall	1,321	432	33

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	2,000	2.3	53.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	195	0
Infil	0	0
Supply	2,000	0
Mincfm	0	0
Return	2,000	0
Exhaust	195	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	9.8
Clg Cfm/Sqft	1.29
Clg Cfm/Ton	400.00
Clg Sqft/Ton	311.00
Clg Btuh/Sqft	38.59
No. People	5
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	54.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.9	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

---------- S Y S T E M   L O A D   P R O F I L E ----------

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.3	9	198	-89,921	35	758	100.0	0	0	0.0	0	0
5 - 10	0.5	7	164	-179,842	12	269	200.0	0	0	0.0	0	0
10 - 15	0.8	10	230	-269,763	13	277	300.0	0	0	0.0	0	0
15 - 20	1.0	6	141	-359,684	14	295	400.0	0	0	0.0	0	0
20 - 25	1.3	7	170	-449,605	14	307	500.0	0	0	0.0	0	0
25 - 30	1.5	9	205	-539,526	12	259	600.0	0	0	0.0	0	0
30 - 35	1.8	10	235	-629,447	0	0	700.0	0	0	0.0	0	0
35 - 40	2.0	7	169	-719,368	0	0	800.0	0	0	0.0	0	0
40 - 45	2.3	9	204	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	9	196	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	7	166	-989,131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	3	66	-1,079,052	0	0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	5	108	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	2	43	-1,258,894	0	0	1,400.0	0	0	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 80	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	0
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	0
85 - 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	0
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	0
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,312	0.0	0	0
Hours Off	0.0	0	6,465	0	0	6,595	0.0	0	6,448	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	17,002	85	2,557	12
Feb	15,293	85	1,952	11
March	17,398	85	472	7
April	15,143	83	0	2
May	17,761	99	0	0
June	18,988	100	0	0
July	18,367	100	0	0
Aug	19,749	100	0	0
Sept	16,440	98	0	0
Oct	16,518	97	0	0
Nov	15,530	85	442	5
Dec	16,173	85	1,690	9
Total	204,363	100	7,112	12

Building Energy Consumption = 33,863 (Btu/Sq Ft/Year)   Floor Area = 41,601 (Sq Ft)
Source Energy Consumption = 34,392 (Btu/Sq Ft/Year)

DANFOSS

RA 2000

Thermostatic Radiator Valves

NEW!

Improve heating system balance, comfort, and fuel efficiency.

D7-17

DANFOSS RA 2000... loaded with smart features and benefits at a very reasonable price.

The Danfoss RA 2000 is your best thermostatic radiator valve buy, for several reasons:

RA 2000 thermostatic radiator valves utilize the latest vapor-filled bellows system from Danfoss, the trusted worldwide leader in thermostatic radiator valves for over 30 years.

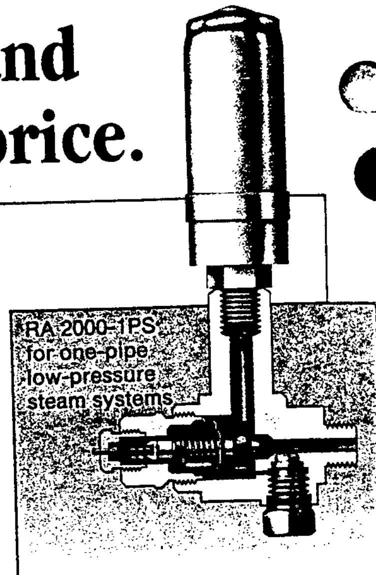
RA 2000 installation is easy, thanks to (A) the rugged snap-on fitting of the operator to the valve and (B) the convenient choice of straight, angle, sidemount, and unique one-pipe steam valves. The adjustable capillary streamlines remote sensor installation, too.

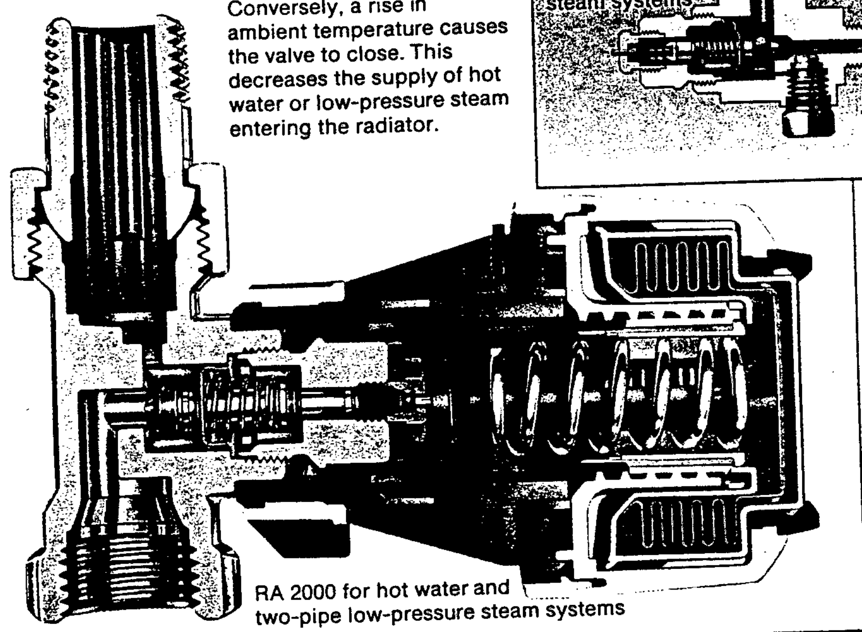
For the building owner and tenant, RA 2000 thermostatic radiator valves feature a designer-style look; an improved maximum/minimum temperature limit and lock; and an easy-to-use memory ring. A special tamper-resistant model with heavy-duty collar, setting lock, and operator/valve connection lock is available for applications where vandalism and abuse are primary concerns.

Add the dramatic improvement in hot water, one- or two-pipe low-pressure steam heating system balance, comfort, and fuel efficiency, and the RA 2000 becomes an exceptional value for the dollar.

Based on a modulating proportional principle, a drop in ambient temperature causes the valve to open. On a hot water or two-pipe steam system, this increases the supply of hot water or low-pressure steam entering the radiator.

Conversely, a rise in ambient temperature causes the valve to close. This decreases the supply of hot water or low-pressure steam entering the radiator.

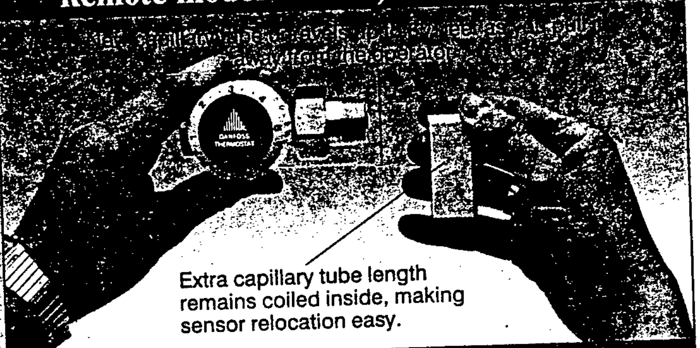




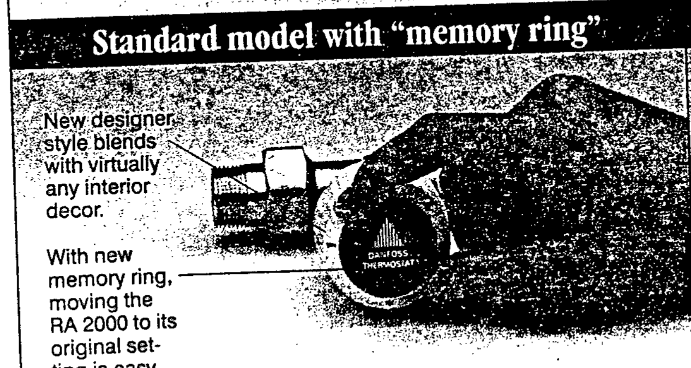
RA 2000 for hot water and two-pipe low-pressure steam systems

Heavy-duty tamper-resistant model

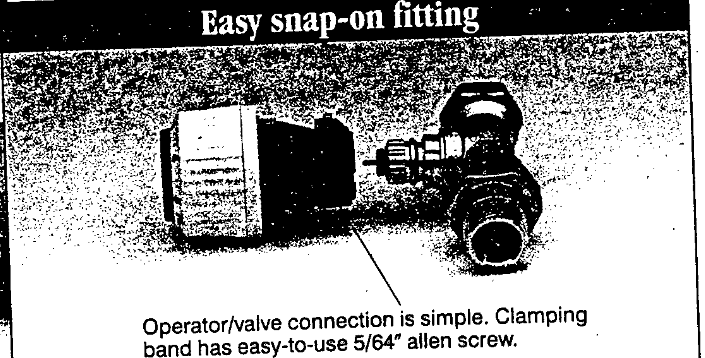
Remote model with adjustable capillary



Standard model with "memory ring"



Easy snap-on fitting



DANFOSS RA 2000... backed by over 30 years of worldwide TRV engineering experience.

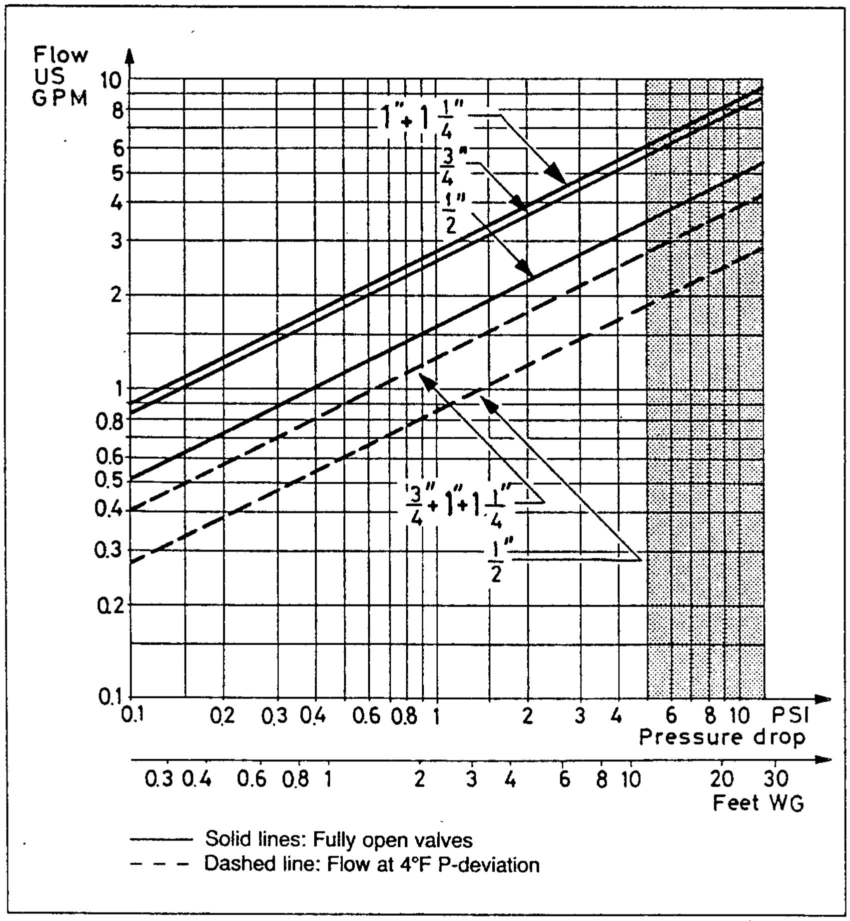
It's no secret that, over the past 30 years, the need for high-efficiency, economical heating systems has been more acute in Europe than in North America. Hence, there has been more of a consistent, long-term incentive for manufacturers, like Danfoss, to invest time and money in product research and development.

Unlike other, newer TRV brands on the market, Danfoss enjoys a reputation as the best TRV manufacturer in the world, with literally millions of valves operating in buildings around the world. By investing in Danfoss TRVs, you benefit from this wealth of laboratory and application engineering experience.

Danfoss supports you with an extensive network of local distributors, regional representatives, and full-time Danfoss hydronic heating specialists based in our local headquarters.

What's the bottom line? Danfoss RA 2000 TRVs are engineered, tested, and manufactured for top quality...quality you can rely upon for all your residential, commercial, or institutional hydronic heating system needs to the year 2000 and beyond.

	Max. test pressure	Max. static pressure	Max. sensor temperature	Max. diff. pressure (hot water)	Temp. range	Max. steam pressure
Hot water & 2-pipe LPS	232 psi (536 ft.)	145 psi (335 ft.)	140°F	20 psi (46 ft.)	43-82°F	15 psig
1-pipe LPS	—	—	140°F	—	43-82°F	15 psig



Important
P-deviation refers to the difference between the thermostat setting and the actual sensor temperature (i.e. room temperature). For best comfort and long life, valves should be selected which provide the design heating load at approximately a 4°F P-deviation.

Quick reference capacity chart for RA 2000 valves for 2-pipe low-pressure steam and hot water.

Pressure drop		1 psi (2.3 ft.)		2 psi (4.6 ft.)		3 psi (6.9 ft.)		4 psi (9.2 ft.)		15 psi (34.6 ft.)	
P-deviation °F		4	fully open	4	fully open	4	fully open	4	fully open	4	fully open
Valve size	Rating code										
½"	MBh	10	16	14	22	16	28	20	32	35	62
¾"	MBh	15	30	20	40	28	50	32	58	60	108
1" + 1¼"	MBh	18	40	25	52	30	60	36	72	66	140

Hot water capacity is based on a 20°F temp. drop through radiation where 1 gpm flow = approx. 10,000 Btu/h

Note: Use shaded area for quick sizing method only. For more detailed information about valve selection refer to RA 2000 engineering data sheet.

To convert: psi to feet of head = psi x 2.31 • Feet of head to psi = feet of head x 0.433 • Sq. ft. EDR to Btu/h = sq. ft. EDR x 240 (steam).
• Btu/h to sq. ft. EDR = Btu/h ÷ 240 • One MBh = 1.000 Btu/h. • EDR = Equivalent Direct Radiation.

DANFOSS RA 2000... easy to order and available today with all the accessories you need.

			Operators					
			Capillary tube length					
					6½'	3' + 3'	6'	16'
Configuration	Connection FPT x MPT	Cv	013G8200	013G8220	013G8202	013G8233	013G8262	013G8265
Hot water and 2 pipe LPS	½" NPT	1.6	013G8015					
	¾" NPT	2.7	013G8020					
	1" NPT	2.8	013G8025					
	1¼" NPT	2.8	013G8032					
	½" NPT	1.6			013G8014			
	¾" NPT	2.7			013G8019			
	1" NPT	2.8			013G8024			
	1¼" NPT	2.8			013G8031			
	½" NPT	1.6	013G8013					
	¾" NPT	2.7	013G8018					
	1" NPT	2.8	013G8023					
	1¼" NPT	2.8	013G8030					
	½" Double Solder union	1.6	013G8042					
	¾" Double Solder union	2.7	013G8044					
1 pipe LPS	⅛" NPT		013G0140					

Parts and accessories							
Configuration	Description						
	Tool set			013G1236			
	Limitation pins		013G1237				
	Cover plug for locking screw			013G1232			
	Cover plate for temp. limitations	013G1235		013G1235			
	Cover plate for scale		013G1233				
	Staple gun			013L1239			
	Packing gland for valves			013G0290			
	Sensor guard				013-0030		
	Tamper kit				013-7064		
	°F dial					013X1145	013X1145
	1-pipe steam Air vent			013L8011			
	Brass 45° street elbow for convector applications (order 2 pcs. per 1PS valve)				013L8300		

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 300 – ENERGY EFFICIENT LIGHTING			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/23/92	ECONOMIC LIFE:	25	PREPARED BY:	A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=	$38,783		
B. SIOH COST	(5.5% of 1A) =	$2,133		
C. DESIGN COST	(6.0% of 1A) =	$2,327		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$43,243		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$43,243	

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	208	$1,345	15.23	$20,485	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	(18)	($40)	19.64	($787)	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		190	1,305.0		————>	$19,698

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $5,909

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $86,737

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $86,737

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $6,500

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.61

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

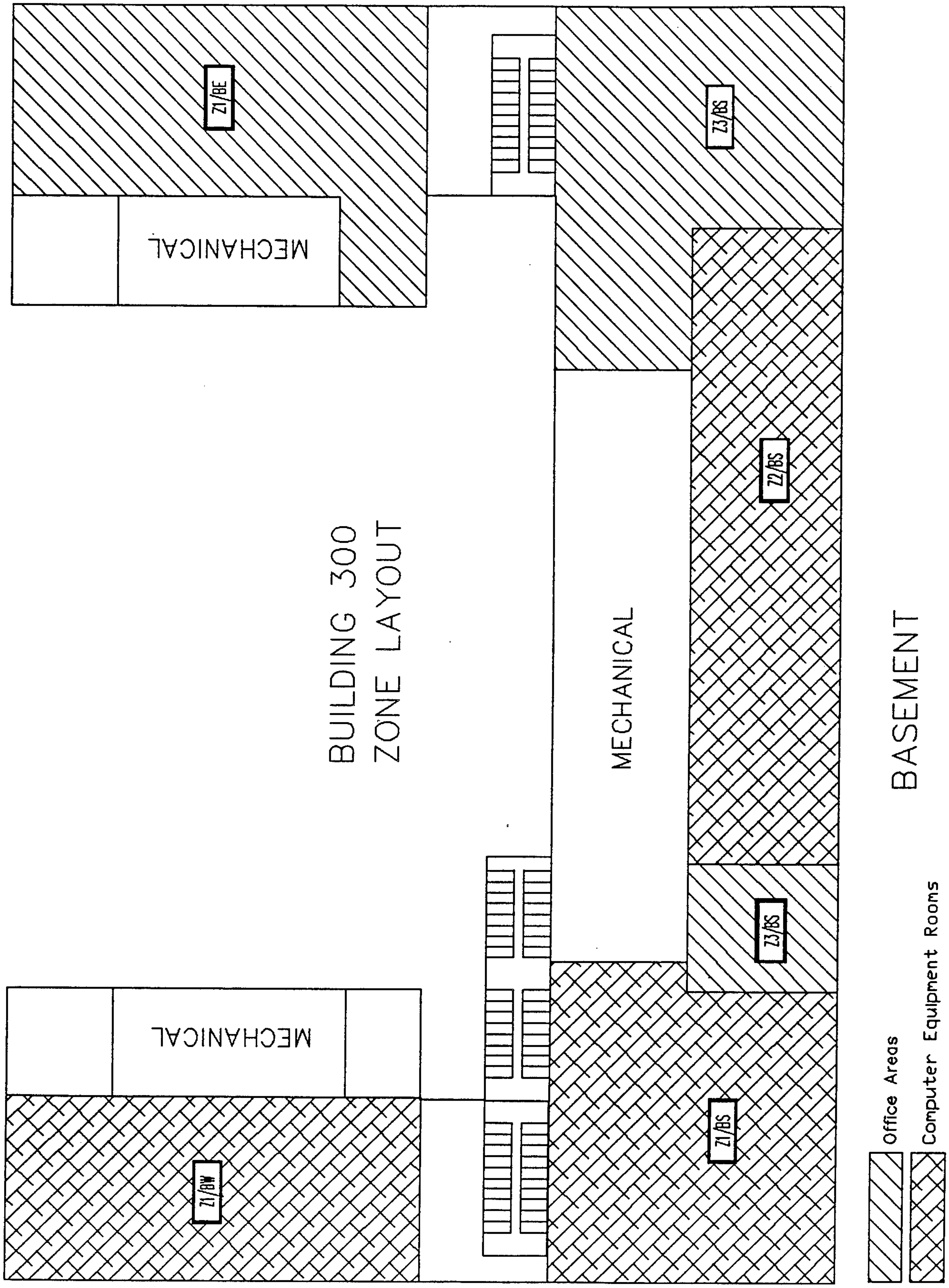
4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$7,213
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$106,435
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.46
7 SIMPLE PAYBACK (SPB)	(1F/4) =	5.99

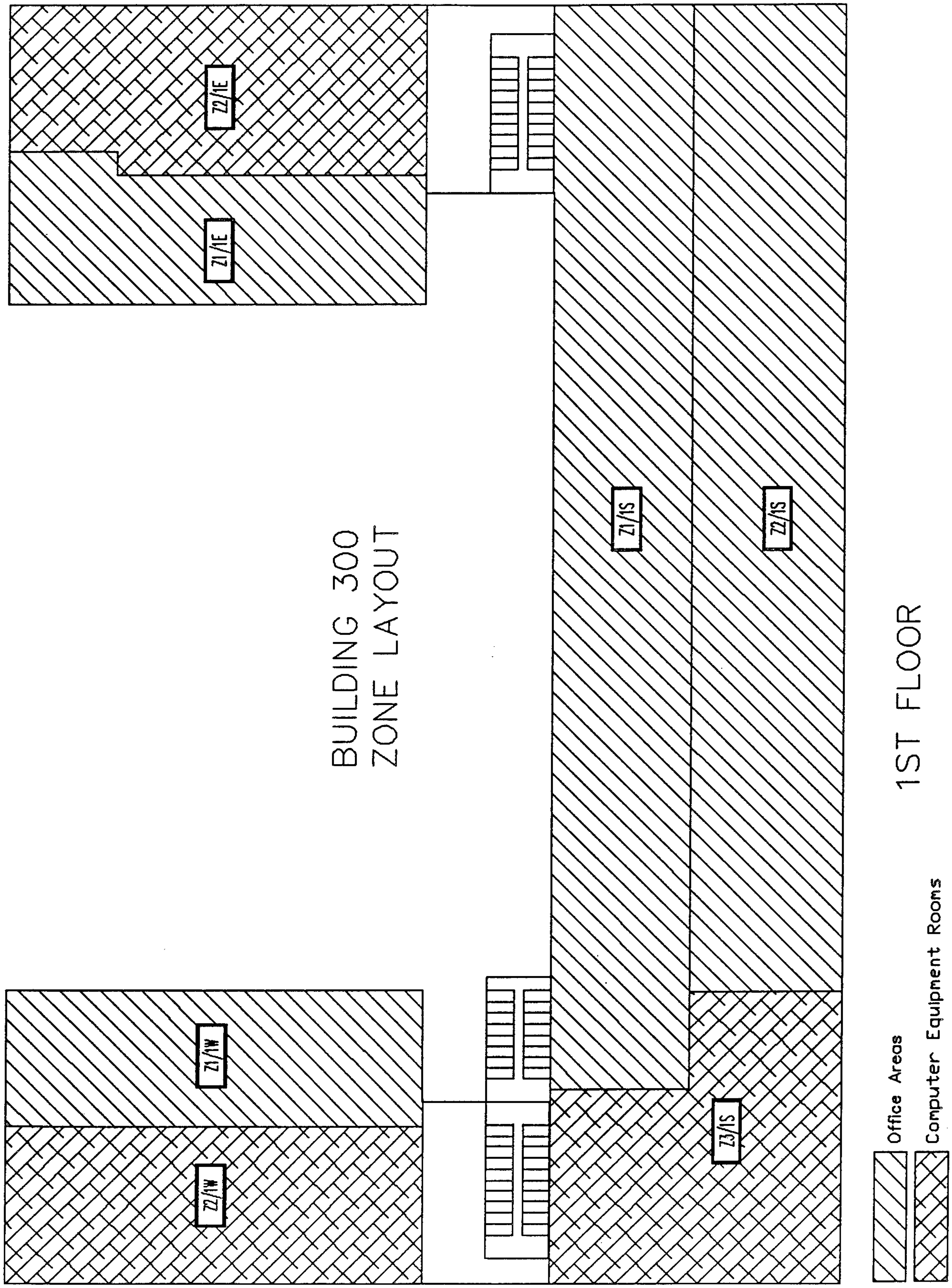
CONSTRUCTION COST ESTIMATE BREAKDOWN

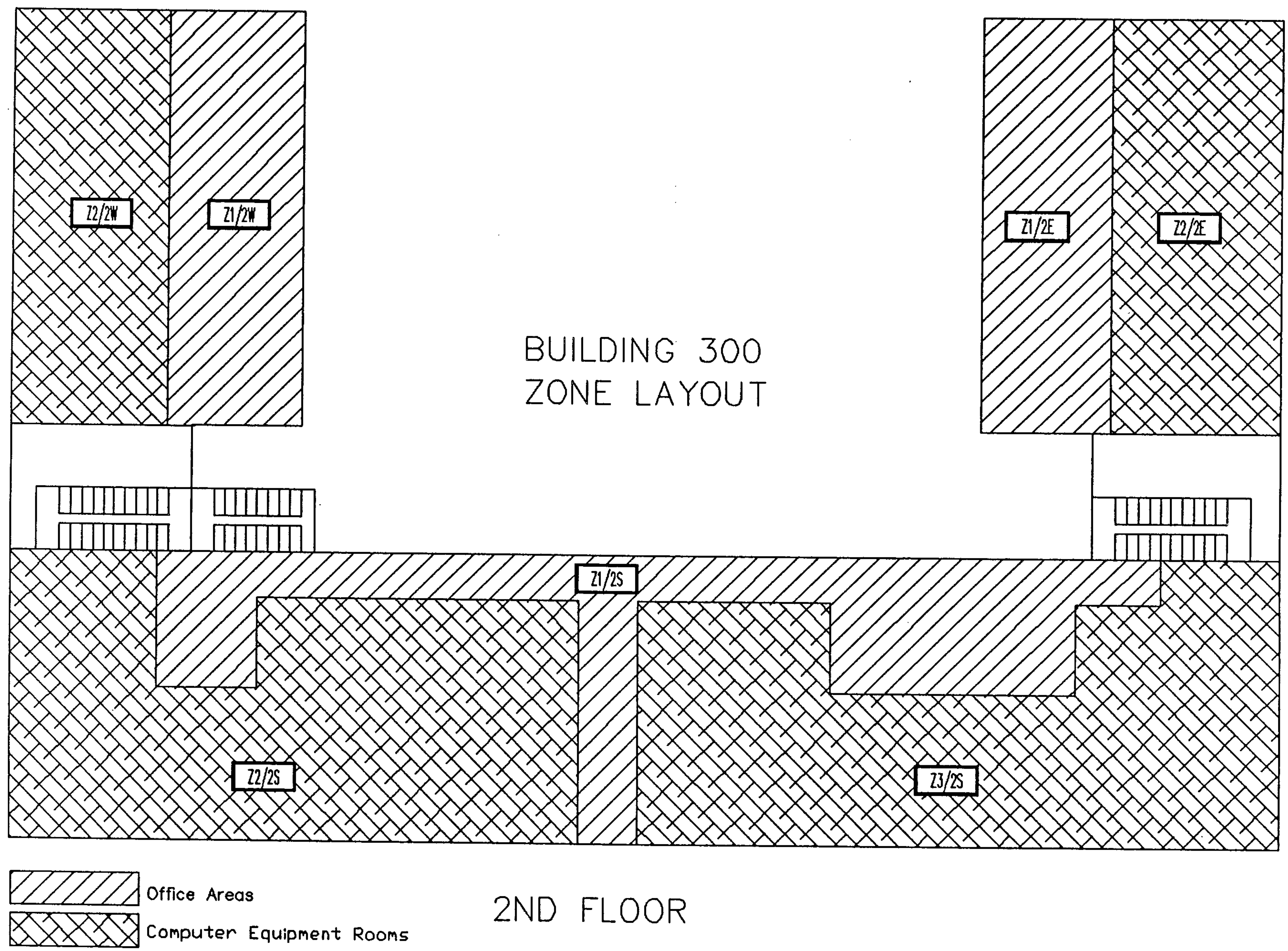
CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 300	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER
WORK LOCATION	WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST		LABOR COSTS			Other Direct Costs (9)	Line Total (10)
				Unit (4)	Total (5)	Manhours Mandays (6)	Average Rate (7)	Total (8)		
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	1652	2.19	3617.88	0.09	27.60	4012.38		$7,630.26
	ENERGY EFFICIENT BALLASTS	EA	808	14.06	11360.48	0.85	27.60	18977.98		$30,338.46
	DIMMING BALLASTS	EA	18	21.75	391.50	0.85	27.60	422.78		$814.28
	TOTAL THIS SHEET									$38,783.00

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1


BUILDING 300
ZONE LAYOUT
BASEMENT
MECHANICAL
MECHANICAL
MECHANICAL
Z1/BE
Z3/BS
Z2/BS
Z3/BS
Z1/BS
Z1/BW
Office Areas
Computer Equipment Rooms


BUILDING 300
ZONE LAYOUT
1ST FLOOR
Z2/1E
Z1/1E
Z1/1S
Z2/1S
Z1/1W
Z2/1W
Z3/1S
Office Areas
Computer Equipment Rooms


BUILDING 300
ZONE LAYOUT
Z2/2W
Z1/2W
Z1/2E
Z2/2E
Z1/2S
Z2/2S
Z3/2S
Office Areas
Computer Equipment Rooms
2ND FLOOR

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******************************************************************************
******************************************************************************
**                                                                          **
**                 T R A C E   6 0 0   A N A L Y S I S                      **
**                                                                          **
**                 by            **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ~~ALT2-ECO~~

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 5:50 3/13/92
Dataset Name: 300 .TM

System 1 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr: 7/16				*	Mo/Hr: 7/16		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				*	OADB: 97		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	12,734		12,734	2.70	*	0	0.00	*	0	-13,550	3.56
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	81,136	27,781		108,917	23.06	*	81,117	28.85	*	-128,969	-173,237	45.46
Partition	-4,965			-4,965	-1.05	*	-4,965	-1.77	*	-60,134	-60,134	15.78
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	6,185			6,185	1.31	*	7,886	2.80	*	-14,848	-14,848	3.90
Sub Total==>	82,355	40,515		122,871	26.01	*	84,038	29.88	*	-203,952	-261,770	68.69
Internal Loads						*			*			
Lights	60,341	0		60,341	12.77	*	60,341	21.46	*	0	0	0.00
People	27,300			27,300	5.78	*	14,950	5.32	*	0	0	0.00
Misc	103,877	0	0	103,877	21.99	*	103,877	36.94	*	0	0	0.00
Sub Total==>	191,518	0	0	191,518	40.54	*	179,168	63.71	*	0	0	0.00
Ceiling Load	3,991	-3,991		0	0.00	*	3,230	1.15	*	-4,628	0	0.00
Outside Air	0	0	0	62,240	13.18	*	0	0.00	*	0	-149,417	39.21
Sup. Fan Heat				84,211	17.83	*		0.00	*		84,211	-22.10
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	14,770			14,770	3.13	*	14,770	5.25	*	-58,220	-58,220	15.28
Exhaust Heat		-3,250	0	-3,250	-0.69	*		0.00	*		4,116	-1.08
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	292,634	33,274	0	472,359	100.00	*	281,206	100.00	*	-266,799	-381,080	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity		Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR		
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains
Main Clg	39.4	472.4	478.2	46,440	74.7	58.0	56.8	63.8	54.1	57.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.4	472.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

------------HEATING COIL SELECTION------------

	Capacity	Coil Airfl	Ent	Lvg
	(Mbh)	(cfm)	Deg F	Deg F
Main Htg	-340.6	46,440	70.3	78.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	46,440	67.4	63.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-340.6			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	3,251	3,251
Infil	323	323
Supply	46,440	46,440
Mincfm	0	0
Return	46,440	46,440
Exhaust	3,251	3,251
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.85
Clg Cfm/Ton	1179.78
Clg Sqft/Ton	306.51
Clg Btuh/Sqft	39.15
No. People	65
Htg % OA	7.0
Htg Cfm/SqFt	3.85
Htg Btuh/SqFt	-28.23

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.7	78.0
Plenum	73.0	70.5
Return	73.0	70.7
Ret/OA	74.7	67.4
Runarnd	72.0	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

System 2 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************* HEATING COIL PEAK ********

	COOLING COIL PEAK						CLG SPACE PEAK			HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					*	Mo/Hr: 7/16		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					*	OADB: 97		*	OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	12,709		12,709	2.03	*	0	0.00	*	0	-13,608	4.14
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	72,716	24,577		97,293	15.58	*	72,716	16.75	*	-124,832	-167,314	50.84
Partition	-5,411			-5,411	-0.87	*	-5,411	-1.25	*	-64,928	-64,928	19.73
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	7,121			7,121	1.14	*	7,885	1.82	*	-14,848	-14,848	4.51
Sub Total==>	74,427	37,286		111,713	17.89	*	75,191	17.32	*	-204,608	-260,698	79.22
Internal Loads						*			*			
Lights	73,523	0		73,523	11.77	*	73,523	16.93	*	0	0	0.00
People	19,740			19,740	3.16	*	10,810	2.49	*	0	0	0.00
Misc	266,323	0	0	266,323	42.64	*	266,323	61.34	*	0	0	0.00
Sub Total==>	359,585	0	0	359,585	57.57	*	350,655	80.76	*	0	0	0.00
Ceiling Load	4,319	-4,319		0	0.00	*	3,459	0.80	*	-5,209	0	0.00
Outside Air	0	0	0	60,882	9.75	*	0	0.00	*	0	-126,942	38.58
Sup. Fan Heat				90,495	14.49	*		0.00	*		90,495	-27.50
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	4,876			4,876	0.78	*	4,876	1.12	*	-35,774	-35,774	10.87
Exhaust Heat		-2,988	0	-2,988	-0.48	*		0.00	*		3,851	-1.17
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
Grand Total==>	443,207	29,979	0	624,563	100.00	*	434,181	100.00	*	-245,591	-329,069	100.00

---------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	52.0	624.6	622.4	39,460	74.8	57.0	52.4	58.1	50.8	52.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	52.0	624.6								

--------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

-----------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	39,460	67.4	78.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	39,460	67.3	58.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-420.2			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,762	2,762
Infil	323	323
Supply	39,460	39,460
Mincfm	0	0
Return	39,460	39,460
Exhaust	2,762	2,762
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.27
Clg Cfm/Ton	758.16
Clg Sqft/Ton	231.81
Clg Btuh/Sqft	51.77
No. People	47
Htg % OA	7.0
Htg Cfm/SqFt	3.27
Htg Btuh/SqFt	-34.83

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.5	78.5
Plenum	73.1	70.4
Return	73.1	70.5
Ret/OA	74.8	67.3
Runarnd	72.0	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>	Mo/Hr: 7/16	Mo/Hr: 7/16	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0	OADB: 97	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	41,022		41,022	2.65	0	0.00	0	-43,963	5.50
Glass Solar	14,028	0		14,028	0.91	40,581	4.51	0	0	0.00
Glass Cond	8,239	0		8,239	0.53	5,819	0.65	-16,967	-16,967	2.12
Wall Cond	147,401	52,964		200,366	12.94	135,487	15.06	-266,726	-361,665	45.23
Partition	-12,991			-12,991	-0.84	-12,991	-1.44	-149,871	-149,871	18.74
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	20,007			20,007	1.29	23,124	2.57	-45,361	-45,361	5.67
Sub Total==>	176,683	93,986		270,670	17.48	192,019	21.34	-478,926	-617,828	77.27
Internal Loads										
Lights	238,645	0		238,645	15.41	238,645	26.52	0	0	0.00
People	64,680			64,680	4.18	35,420	3.94	0	0	0.00
Misc	425,318	0	0	425,318	27.47	425,318	47.27	3,208	3,208	-0.40
Sub Total==>	728,643	0	0	728,643	47.06	699,382	77.72	3,208	3,208	-0.40
Ceiling Load	7,657	-7,657		0	0.00	7,258	0.81	-11,689	0	0.00
Outside Air	0	0	0	189,859	12.26	0	0.00	0	-430,464	53.84
Sup. Fan Heat				363,958	23.51		0.00		363,958	-45.52
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	1,182			1,182	0.08	1,182	0.13	-127,578	-127,578	15.96
Exhaust Heat		-5,903	0	-5,903	-0.38		0.00		9,137	-1.14
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	914,165	80,427	0	1,548,408	100.00	899,842	100.00	-614,985	-799,567	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	129.0	1,548.4	1,560.1	133,808	74.4	57.5	55.1	62.1	53.0	55.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	129.0	1,548.4								

--------------AREAS-------------

Gross Total		Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

-----------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	133,808	67.3	76.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	133,808	67.7	62.1
Reheat	0.0	0	0.0	0.0
Humidif	-439.3	10,353	4.7	75.1
Opt Vent	0.0	0	0.0	0.0
Total	-1,658.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	9,366	9,366
Infil	987	987
Supply	133,808	133,808
Mincfm	0	0
Return	133,808	133,808
Exhaust	9,366	9,366
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.64
Clg Cfm/Ton	1037.00
Clg Sqft/Ton	284.50
Clg Btuh/Sqft	42.18
No. People	154
Htg % OA	7.0
Htg Cfm/SqFt	3.64
Htg Btuh/SqFt	-33.21

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.0	76.8
Plenum	72.7	70.9
Return	72.7	71.0
Ret/OA	74.4	67.7
Runarnd	72.0	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F)									Room	Room
		Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Mass (lb/ sqft)	Capac. (Btu/ sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	96
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 300

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	Z1-BSAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0		0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 300

--------------------------------------- S Y S T E M   L O A D   P R O F I L E ---------------------------------------

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	0
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725,737	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	0
35 - 40	88.2	9	801	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	370,311	664	6,458	145	14
Feb	335,056	663	5,227	135	14
March	378,559	692	2,512	182	8
April	374,522	726	585	227	3
May	406,945	754	9	326	0
June	414,722	831	0	382	0
July	433,778	837	0	408	0
Aug	434,746	829	0	398	0
Sept	398,870	757	0	321	0
Oct	394,963	729	782	248	4
Nov	362,831	690	2,815	175	9
Dec	370,472	668	5,163	156	11
Total	4,675,776	837	23,551	3,104	14

Building Energy Consumption = 301,008 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 302,206 (Btu/Sq Ft/Year)

Σ monthly Kw = 8840

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

--------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S ---------------------------------------

Utility   ELECTRIC DEMAND

Peak Value   837.1   (kW)
Yearly Time of Peak 16 (hr)   7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1001S	2-STG CTV <555 TONS	179.4	21.43
2	EQ1122L	AIR-CLD RECIP >55 TONS	111.0	13.27
Sub Total			290.4	34.69
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	5.79
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.01
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	14.26
Sub Total			201.4	24.06
Sub Total			0.0	0.00
Miscellaneous				
Lights			109.1	13.04
Base Utilities			0.0	0.00
Misc Equipment			236.2	28.21
Sub Total			345.3	41.25
Grand Total			837.1	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                          **
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**              by          **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO (ENERGY EFFICIENT LIGHTING)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 6:55:35 6/23/92
Dataset Name: 300 .TM

System 1 Block DD - DOUBLE DUCT

***** COOLING COIL PEAK *****						* CLG SPACE PEAK *		* HEATING COIL PEAK *		
Peaked at Time ==>		Mo/Hr: 7/16				Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,734		12,734	2.76	0	0.00	0	-13,550	3.56
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	81,136	27,781		108,917	23.64	81,117	30.04	-128,969	-173,237	45.46
Partition	-4,965			-4,965	-1.08	-4,965	-1.84	-60,134	-60,134	15.78
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	6,151			6,151	1.33	7,886	2.92	-14,848	-14,848	3.90
Sub Total==>	82,321	40,515		122,836	26.66	84,038	31.12	-203,952	-261,770	68.69
Internal Loads										
Lights	48,829	0		48,829	10.60	48,829	18.08	0	0	0.00
People	27,300			27,300	5.92	14,950	5.54	0	0	0.00
Misc	103,877	0	0	103,877	22.54	103,877	38.47	0	0	0.00
Sub Total==>	180,006	0	0	180,006	39.07	167,656	62.09	0	0	0.00
Ceiling Load	3,991	-3,991		0	0.00	3,230	1.20	-4,628	0	0.00
Outside Air	0	0	0	61,893	13.43	0	0.00	0	-149,417	39.21
Sup. Fan Heat				84,211	18.28		0.00		84,211	-22.10
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	15,084			15,084	3.27	15,084	5.59	-58,220	-58,220	15.28
Exhaust Heat		-3,250	0	-3,250	-0.71		0.00		4,116	-1.08
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	281,402	33,274	0	460,781	100.00	270,008	100.00	-266,799	-381,080	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	38.4	460.8	467.0	46,440	74.7	58.0	57.0	64.0	54.3	57.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	38.4	460.8								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-340.6	46,440	70.3	78.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	46,440	67.4	64.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-340.6			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	3,251	3,251
Infil	323	323
Supply	46,440	46,440
Mincfm	0	0
Return	46,440	46,440
Exhaust	3,251	3,251
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	7.0
Clg Cfm/Sqft	3.85
Clg Cfm/Ton	1209.43
Clg Sqft/Ton	314.21
Clg Btuh/Sqft	38.19
No. People	65
Htg % OA	7.0
Htg Cfm/SqFt	3.85
Htg Btuh/SqFt	-28.23

TEMPERATURES (F)

Type	Clg	Htg
SADB	65.9	78.0
Plenum	73.0	70.5
Return	73.0	70.7
Ret/OA	74.7	67.4
Runarnd	72.0	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

System 2 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,709		12,709	2.04	0	0.00	0	-13,608	4.14
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	72,716	24,577		97,293	15.58	72,716	16.75	-124,832	-167,314	50.84
Partition	-5,411			-5,411	-0.87	-5,411	-1.25	-64,928	-64,928	19.73
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	7,104			7,104	1.14	7,885	1.82	-14,848	-14,848	4.51
Sub Total==>	74,410	37,286		111,695	17.89	75,191	17.32	-204,608	-260,698	79.22
Internal Loads										
Lights	59,476	0		59,476	9.53	59,476	13.70	0	0	0.00
People	19,740			19,740	3.16	10,810	2.49	0	0	0.00
Misc	266,323	0	0	266,323	42.65	266,323	61.34	0	0	0.00
Sub Total==>	345,538	0	0	345,538	55.34	336,608	77.53	0	0	0.00
Ceiling Load	4,319	-4,319		0	0.00	3,459	0.80	-5,209	0	0.00
Outside Air	0	0	0	60,736	9.73	0	0.00	0	-126,942	38.58
Sup. Fan Heat				90,495	14.49		0.00		90,495	-27.50
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	18,910			18,910	3.03	18,910	4.36	-35,774	-35,774	10.87
Exhaust Heat		-2,988	0	-2,988	-0.48		0.00		3,851	-1.17
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	443,177	29,979	0	624,388	100.00	434,168	100.00	-245,591	-329,069	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	52.0	624.4	622.4	39,460	74.8	57.0	52.5	58.1	50.8	52.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	52.0	624.4								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	39,460	67.4	78.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	39,460	67.3	58.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-420.2			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	2,762	2,762
Infil	323	323
Supply	39,460	39,460
Mincfm	0	0
Return	39,460	39,460
Exhaust	2,762	2,762
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.27
Clg Cfm/Ton	758.37
Clg Sqft/Ton	231.88
Clg Btuh/Sqft	51.75
No. People	47
Htg % OA	7.0
Htg Cfm/SqFt	3.27
Htg Btuh/SqFt	-34.83

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.5	78.5
Plenum	73.1	70.4
Return	73.1	70.5
Ret/OA	74.8	67.3
Runarnd	72.0	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr: 7/16				*	Mo/Hr: 7/16		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				*	OADB: 97		*		OADB: 24	
	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	41,022		41,022	2.65	*	0	0.00	*	0	-43,963	5.50
Glass Solar	14,028	0		14,028	0.91	*	40,581	4.52	*	0	0	0.00
Glass Cond	8,239	0		8,239	0.53	*	5,819	0.65	*	-16,967	-16,967	2.12
Wall Cond	147,401	52,964		200,366	12.95	*	135,487	15.08	*	-266,726	-361,665	45.23
Partition	-12,991			-12,991	-0.84	*	-12,991	-1.45	*	-149,871	-149,871	18.74
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	19,989			19,989	1.29	*	23,124	2.57	*	-45,361	-45,361	5.67
Sub Total==>	176,665	93,986		270,652	17.50	*	192,019	21.37	*	-478,926	-617,828	77.27
Internal Loads						*			*			
Lights	193,225	0		193,225	12.49	*	193,225	21.50	*	0	0	0.00
People	64,680			64,680	4.18	*	35,420	3.94	*	0	0	0.00
Misc	425,318	0	0	425,318	27.49	*	425,318	47.33	*	3,208	3,208	-0.40
Sub Total==>	683,223	0	0	683,223	44.17	*	653,963	72.78	*	3,208	3,208	-0.40
Ceiling Load	7,657	-7,657		0	0.00	*	7,258	0.81	*	-11,689	0	0.00
Outside Air	0	0	0	189,687	12.26	*	0	0.00	*	0	-430,464	53.84
Sup. Fan Heat				363,958	23.53	*		0.00	*		363,958	-45.52
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	45,353			45,353	2.93	*	45,353	5.05	*	-127,578	-127,578	15.96
Exhaust Heat		-5,903	0	-5,903	-0.38	*		0.00	*		9,137	-1.14
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
Grand Total==>	912,898	80,427	0	1,546,969	100.00	*	898,593	100.00	*	-614,985	-799,567	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	128.9	1,547.0	1,558.8	133,808	74.4	57.5	55.1	62.1	53.0	55.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	128.9	1,547.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	133,808	67.3	76.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	133,808	67.7	62.1
Reheat	0.0	0	0.0	0.0
Humidif	-439.3	10,353	4.7	75.1
Opt Vent	0.0	0	0.0	0.0
Total	-1,658.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	9,366	9,366
Infil	987	987
Supply	133,808	133,808
Mincfm	0	0
Return	133,808	133,808
Exhaust	9,366	9,366
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.64
Clg Cfm/Ton	1037.96
Clg Sqft/Ton	284.76
Clg Btuh/Sqft	42.14
No. People	154
Htg % OA	7.0
Htg Cfm/SqFt	3.64
Htg Btuh/SqFt	-33.21

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.0	76.8
Plenum	72.7	70.9
Return	72.7	71.0
Ret/OA	74.4	67.7
Runarnd	72.0	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 2
ECO - EFFICIENT LIGHTING - BUILDING 300

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

		Room U-Values (Btu/hr/sqft/F)									Room Mass	Room Capac.
Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	(lb/ sqft)	(Btu/ sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 2
ECO - EFFICIENT LIGHTING - BUILDING 300

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	Z1-BSMT EAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0	0	0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2
ECO - EFFICIENT LIGHTING - BUILDING 300

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	11.0	0	0	-120,956	23	989	10,985.4	0	0	0.0	0	0
5 - 10	21.9	0	0	-241,912	18	774	21,970.8	0	0	0.0	0	0
10 - 15	32.9	0	0	-362,869	16	681	32,956.2	0	0	0.0	0	0
15 - 20	43.9	10	881	-483,825	13	564	43,941.6	0	0	0.0	0	0
20 - 25	54.8	17	1,526	-604,781	13	549	54,927.0	0	0	0.0	0	0
25 - 30	65.8	12	1,041	-725,737	8	372	65,912.4	0	0	0.0	0	0
30 - 35	76.8	8	678	-846,693	5	233	76,897.8	0	0	0.0	0	0
35 - 40	87.7	8	730	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	98.7	5	445	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	109.7	8	685	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	120.6	7	603	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	131.6	5	468	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	142.6	5	456	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	153.5	5	410	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	164.5	3	258	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	175.5	3	238	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	186.4	2	148	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	197.4	1	130	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	208.4	1	63	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	219.3	0	0	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,380	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	365,820	642	6,514	142	14
Feb	330,979	642	5,274	132	14
March	373,520	664	2,530	178	8
April	369,982	699	586	223	3
May	401,888	728	9	321	0
June	408,654	804	0	383	0
July	428,154	811	0	409	0
Aug	427,477	802	0	405	0
Sept	394,179	731	0	317	0
Oct	389,998	703	782	244	4
Nov	358,160	667	2,834	171	9
Dec	366,100	644	5,204	153	11
Total	4,614,913	811	23,732	3,078	14

Building Energy Consumption = 297,893 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 299,099 (Btu/Sq Ft/Year)

Σ Monthly KW = 8537

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

--------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S ---------------------------------------

Utility ELECTRIC DEMAND

Peak Value 811.3 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1001S	2-STG CTV <555 TONS	176.4	21.75
2	EQ1122L	AIR-CLD RECIP >55 TONS	108.9	13.43
Sub Total			285.4	35.17
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	5.98
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.14
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	14.71
Sub Total			201.4	24.83
Sub Total			0.0	0.00
Miscellaneous				
Lights			88.3	10.89
Base Utilities			0.0	0.00
Misc Equipment			236.2	29.11
Sub Total			324.5	40.00
Grand Total			811.3	100.00

BLDG P300 LIGHTING CALCULATIONS

ZONE #1

INSTALLED FIXTURES (IF):

51 X 96 Watts = 4896 Watts
25 X 71 Watts = 1775 Watts
Total Watts : 6671 Watts

1.5 Watts/SF is assummed for existing lighting
3595 SF is the zone floor area
76 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

5393 Watts (observed) /
6671 Watts (installed fixtures)
= 0.81

INSTALLED FIXT. X EFFECT. LAMP FACTOR

41 Effective # of existing standard fixtures
20 Effective # of low–wattage fixtures
= 61 Total Fixtures

COST ESTIMATE:

82 Replacement Lamps
40 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.21 Watts/SF

ZONE #2

INSTALLED FIXTURES (IF):

25 X 96 Watts = 2400 Watts
13 X 71 Watts = 923 Watts
Total Watts : 3323 Watts

1.7 Watts/SF is assummed for existing lighting
1595 SF is the zone floor area
38 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

2712 Watts (observed) /
3323 Watts (installed fixtures)
= 0.82

INSTALLED FIXT. X EFFECT. LAMP FACTOR

20 Effective # of existing standard fixtures
11 Effective # of low–wattage fixtures
= 31 Total Fixtures

COST ESTIMATE:

41 Replacement Lamps
20 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.38 Watts/SF

ZONE #3

INSTALLED FIXTURES (IF):

55 X 96 Watts = 5280 Watts
28 X 71 Watts = 1988 Watts
Total Watts : 7268 Watts

0.6 Watts/SF is assummed for existing lighting
2640 SF is the zone floor area
83 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

1584 Watts (observed) /
7268 Watts (installed fixtures)
= 0.22

INSTALLED FIXT. X EFFECT. LAMP FACTOR

12 Effective # of existing standard fixtures
6 Effective # of low–wattage fixtures
= 18 Total Fixtures

COST ESTIMATE:

24 Replacement Lamps
12 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

0.49 Watts/SF

BLDG P300 LIGHTING CALCULATIONS

ZONE #4

INSTALLED FIXTURES (IF):

25 X 96 Watts =	2400 Watts
12 X 71 Watts =	852 Watts
Total Watts :	3252 Watts

1.7 Watts/SF is assummed for existing lighting
1595 SF is the zone floor area
37 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

2712 Watts (observed) /
3252 Watts (installed fixtures)
= 0.83

INSTALLED FIXT. X EFFECT. LAMP FACTOR

21 Effective # of existing standard fixtures
10 Effective # of low-wattage fixtures
= 31 Total Fixtures

COST ESTIMATE:

42 Replacement Lamps
21 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.37 Watts/SF

ZONE #5

INSTALLED FIXTURES (IF):

49 X 96 Watts =	4704 Watts
25 X 71 Watts =	1775 Watts
Total Watts :	6479 Watts

2.0 Watts/SF is assummed for existing lighting
2640 SF is the zone floor area
74 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

5280 Watts (observed) /
6479 Watts (installed fixtures)
= 0.81

INSTALLED FIXT. X EFFECT. LAMP FACTOR

40 Effective # of existing standard fixtures
20 Effective # of low-wattage fixtures
= 60 Total Fixtures

COST ESTIMATE:

80 Replacement Lamps
40 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #6

INSTALLED FIXTURES (IF):

64 X 96 Watts =	6144 Watts
32 X 71 Watts =	2272 Watts
Total Watts :	8416 Watts

2.0 Watts/SF is assummed for existing lighting
3280 SF is the zone floor area
96 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

6560 Watts (observed) /
8416 Watts (installed fixtures)
= 0.78

INSTALLED FIXT. X EFFECT. LAMP FACTOR

50 Effective # of existing standard fixtures
25 Effective # of low-wattage fixtures
= 75 Total Fixtures

COST ESTIMATE:

100 Replacement Lamps
50 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

BLDG P300 LIGHTING CALCULATIONS

ZONE #8

INSTALLED FIXTURES (IF):

30 X 96 Watts = 2880 Watts
15 X 71 Watts = 1065 Watts
Total Watts : 3945 Watts

1.9 Watts/SF is assummed for existing lighting
1595 SF is the zone floor area
45 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

3031 Watts (observed) /
3945 Watts (installed fixtures)
= 0.77

INSTALLED FIXT. X EFFECT. LAMP FACTOR

23 Effective # of existing standard fixtures
12 Effective # of low–wattage fixtures
= 35 Total Fixtures

COST ESTIMATE:

46 Replacement Lamps
23 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.54 Watts/SF

ZONE #9

INSTALLED FIXTURES (IF):

56 X 96 Watts = 5376 Watts
28 X 71 Watts = 1988 Watts
Total Watts : 7364 Watts

2.0 Watts/SF is assummed for existing lighting
2640 SF is the zone floor area
84 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

5280 Watts (observed) /
7364 Watts (installed fixtures)
= 0.72

INSTALLED FIXT. X EFFECT. LAMP FACTOR

40 Effective # of existing standard fixtures
20 Effective # of low–wattage fixtures
= 60 Total Fixtures

COST ESTIMATE:

80 Replacement Lamps
40 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #10

INSTALLED FIXTURES (IF):

25 X 96 Watts = 2400 Watts
12 X 71 Watts = 852 Watts
Total Watts : 3252 Watts

1.7 Watts/SF is assummed for existing lighting
1595 SF is the zone floor area
37 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

2712 Watts (observed) /
3252 Watts (installed fixtures)
= 0.83

INSTALLED FIXT. X EFFECT. LAMP FACTOR

21 Effective # of existing standard fixtures
10 Effective # of low–wattage fixtures
= 31 Total Fixtures

COST ESTIMATE:

42 Replacement Lamps
21 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.37 Watts/SF

BLDG P300 LIGHTING CALCULATIONS

ZONE #11

INSTALLED FIXTURES (IF):

51 X 96 Watts = 4896 Watts
25 X 71 Watts = 1775 Watts
Total Watts : 6671 Watts

1.5 Watts/SF is assummed for existing lighting
2640 SF is the zone floor area
76 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

3960 Watts (observed) /
6671 Watts (installed fixtures)
= 0.59

INSTALLED FIXT. X EFFECT. LAMP FACTOR

30 Effective # of existing standard fixtures
15 Effective # of low-wattage fixtures
= 45 Total Fixtures

COST ESTIMATE:

60 Replacement Lamps
30 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.21 Watts/SF

ZONE #12

INSTALLED FIXTURES (IF):

55 X 96 Watts = 5280 Watts
27 X 71 Watts = 1917 Watts
Total Watts : 7197 Watts

2.0 Watts/SF is assummed for existing lighting
2202 SF is the zone floor area
82 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

4404 Watts (observed) /
7197 Watts (installed fixtures)
= 0.61

INSTALLED FIXT. X EFFECT. LAMP FACTOR

34 Effective # of existing standard fixtures
17 Effective # of low-wattage fixtures
= 50 Total Fixtures

COST ESTIMATE:

68 Replacement Lamps
34 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #13

INSTALLED FIXTURES (IF):

57 X 96 Watts = 5472 Watts
29 X 71 Watts = 2059 Watts
Total Watts : 7531 Watts

2.0 Watts/SF is assummed for existing lighting
3780 SF is the zone floor area
86 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

7560 Watts (observed) /
7531 Watts (installed fixtures)
= 1.00

INSTALLED FIXT. X EFFECT. LAMP FACTOR

57 Effective # of existing standard fixtures
29 Effective # of low-wattage fixtures
= 86 Total Fixtures

COST ESTIMATE:

114 Replacement Lamps
57 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

BLDG P300 LIGHTING CALCULATIONS

ZONE #14

INSTALLED FIXTURES (IF):

54 X 96 Watts = 5184 Watts
27 X 71 Watts = 1917 Watts
Total Watts : 7101 Watts

2.0 Watts/SF is assummed for existing lighting
3688 SF is the zone floor area
81 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

7376 Watts (observed) /
7101 Watts (installed fixtures)
= 1.04

INSTALLED FIXT. X EFFECT. LAMP FACTOR

56 Effective # of existing standard fixtures
28 Effective # of low–wattage fixtures
= 84 Total Fixtures

COST ESTIMATE:

108 Replacement Lamps
54 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #15

INSTALLED FIXTURES (IF):

84 X 96 Watts = 8064 Watts
42 X 71 Watts = 2982 Watts
Total Watts : 11046 Watts

1.9 Watts/SF is assummed for existing lighting
4089 SF is the zone floor area
126 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

7769 Watts (observed) /
11046 Watts (installed fixtures)
= 0.70

INSTALLED FIXT. X EFFECT. LAMP FACTOR

59 Effective # of existing standard fixtures
30 Effective # of low–wattage fixtures
= 89 Total Fixtures

COST ESTIMATE:

118 Replacement Lamps
74 Replacement Ballasts (18 Dimming Ballasts)

TRACE 600 INPUT FOR LIGHTING ECO:

1.54 Watts/SF

ZONE #16

INSTALLED FIXTURES (IF):

94 X 96 Watts = 9024 Watts
46 X 71 Watts = 3266 Watts
Total Watts : 12290 Watts

2.0 Watts/SF is assummed for existing lighting
6002 SF is the zone floor area
140 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

12004 Watts (observed) /
12290 Watts (installed fixtures)
= 0.98

INSTALLED FIXT. X EFFECT. LAMP FACTOR

92 Effective # of existing standard fixtures
45 Effective # of low–wattage fixtures
= 137 Total Fixtures

COST ESTIMATE:

184 Replacement Lamps
92 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

BLDG P300 LIGHTING CALCULATIONS

ZONE #17

INSTALLED FIXTURES (IF):

55 X 96 Watts =	5280	Watts
28 X 71 Watts =	1988	Watts
Total Watts :	7268	Watts

2.0 Watts/SF is assummed for existing lighting
3431 SF is the zone floor area
83 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):
6862 Watts (observed) /
7268 Watts (installed fixtures)
= 0.94

INSTALLED FIXT. X EFFECT. LAMP FACTOR
52 Effective # of existing standard fixtures
26 Effective # of low-wattage fixtures
= 78 Total Fixtures

COST ESTIMATE:
104 Replacement Lamps
52 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:
1.62 Watts/SF

ZONE #18

INSTALLED FIXTURES (IF):

116 X 96 Watts =	11136	Watts
58 X 71 Watts =	4118	Watts
Total Watts :	15254	Watts

1.5 Watts/SF is assummed for existing lighting
5762 SF is the zone floor area
174 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):
8643 Watts (observed) /
15254 Watts (installed fixtures)
= 0.57

INSTALLED FIXT. X EFFECT. LAMP FACTOR
66 Effective # of existing standard fixtures
33 Effective # of low-wattage fixtures
= 99 Total Fixtures

COST ESTIMATE:
132 Replacement Lamps
66 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:
1.21 Watts/SF

ZONE #19

INSTALLED FIXTURES (IF):

28 X 96 Watts =	2688	Watts
14 X 71 Watts =	994	Watts
Total Watts :	3682	Watts

1.9 Watts/SF is assummed for existing lighting
2077 SF is the zone floor area
42 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):
3946 Watts (observed) /
3682 Watts (installed fixtures)
= 1.07

INSTALLED FIXT. X EFFECT. LAMP FACTOR
30 Effective # of existing standard fixtures
15 Effective # of low-wattage fixtures
= 45 Total Fixtures

COST ESTIMATE:
56 Replacement Lamps
28 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:
1.54 Watts/SF

BLDG P300 LIGHTING CALCULATIONS

ZONE #20

INSTALLED FIXTURES (IF):

92 X 96 Watts =	8832 Watts
46 X 71 Watts =	3266 Watts
Total Watts :	12098 Watts

2.0 Watts/SF is assummed for existing lighting
5681 SF is the zone floor area
138 Total # of Fixtures

EFFECTIVE LAMP FACTOR (ELF):

11362 Watts (observed) /
12098 Watts (installed fixtures)
= 0.94

INSTALLED FIXT. X EFFECT. LAMP FACTOR

86 Effective # of existing standard fixtures
43 Effective # of low–wattage fixtures
= 130 Total Fixtures

COST ESTIMATE:

172 Replacement Lamps
86 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 300 – CONSOLIDATED CHILLER PLANT WITH HEAT RECOVERY   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 07/09/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$91,996	
B. SIOH COST	(5.5% of 1A) =	$5,060	
C. DESIGN COST	(6.0% of 1A) =	$5,520	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$102,575	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$102,575

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	377	$2,440	15.23	$37,159	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	2,231	$4,935	19.64	$96,923	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		2,607	7,374.9		————>	$134,082

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS & MAINTENANCE COST SAVINGS) = $6,469

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $94,958

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $94,958

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $44,247

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 1.74

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$13,843
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$229,040
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.23
7 SIMPLE PAYBACK (SPB)	(1F/4) =	7.41

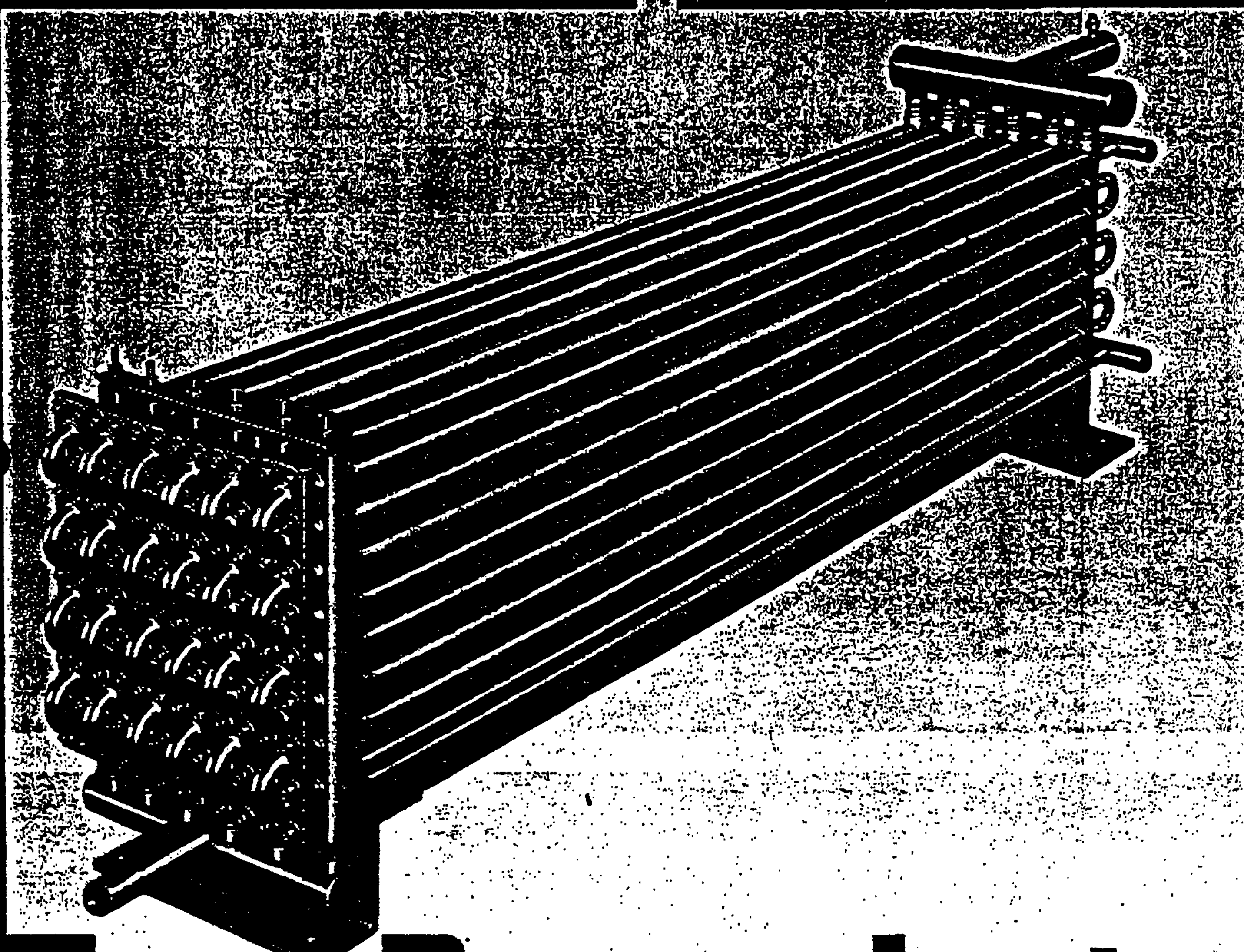
CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) CENTRAL CHILLER PLANT WITH HEAT RECOVERY – BLDG 300	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER
WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	CNTRL CHILLER PLANT W/ HEAT RECOVERY									
	100 Ton Water-Cooled Reciprocating Chiller	EA	1	31500	31500	266.00	35.81	9525.46		$41,025.46
	Hot Gas Heat Exchanger	EA	1	4500	4500.00	40.00	35.81	1432.40		$5,932.40
	6000 gal. HW Storage Tanks w/ Pipe Connections	EA	3	5000	15000.00	40.00	35.81	4297.20		$19,297.20
	HW Storage Tank Insulation	SF	1200	2.64	3168.00	0.20	35.81	8594.40		$11,762.40
	Hot Water Circulation Pumps	EA	3	605.00	1815.00	3.20	35.81	343.78		$2,158.78
	Hot Water Piping (2 in.)	LF	640	3.81	2438.40	0.25	35.81	5729.60		$8,168.00
	Hot Water Pipe Insulation (2 in.)	LF	640	1.98	1267.20	0.08	35.81	1833.47		$3,100.67
	Controls	EA	3	156.00	468.00	1.00	27.60	82.80		$550.80
	TOTAL THIS SHEET									$91,995.71

Source: Means Electric & Mechanical Cost Data, 1992; Haynes Trane Co., Denver CO; Material costs include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

How to save twice with one product.



Trane Desuperheater

TRANE

D9-3

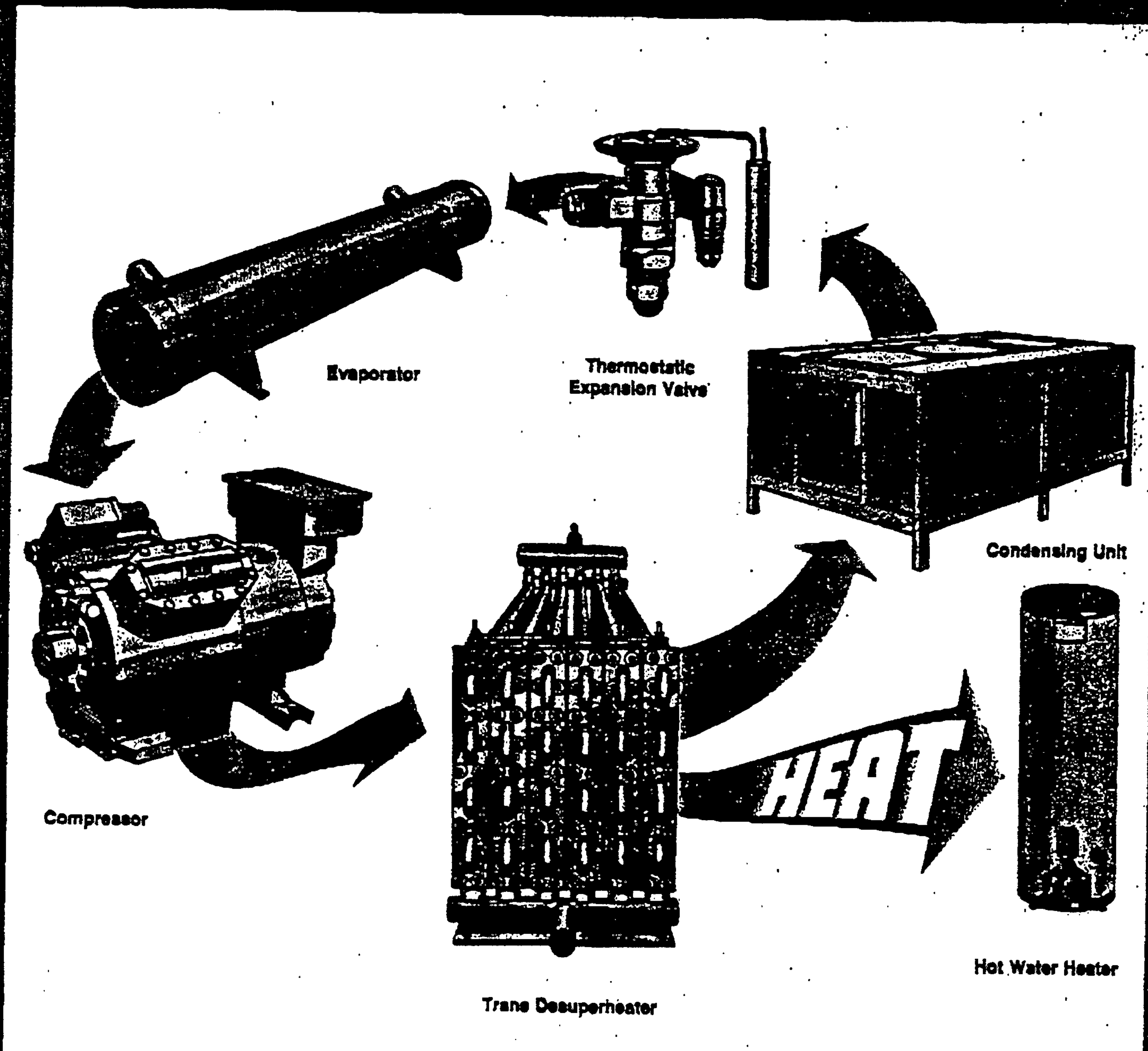
How it works

The energy efficient Trane desuperheater is installed in the hot gas line between your unit's compressor and condenser. As hot refrigerant enters the desuperheater, it moves onto a roll-formed spiral surface that creates a swirling path for the refrigerant to follow. The turbulence created by this innovative design makes it easier for the refrigerant to give up its heat.

At the same time, cold water is piped into a copper tube beneath the spiral surface. Here it receives the heat transferred from the refrigerant and then continues its path according to one of the following systems:

Circulating – used in applications with a varying demand for hot water or with a need for extra hot water. After being heated by the desuperheater, the water flows into a water storage tank. As long as the compressor is in operation, a pump continuously circulates water from the storage tank through the desuperheater, raising the water temperature with each pass.

Preheat – used in applications with continuous compressor operation and a constant demand for hot water. Water flows directly from the desuperheater into the building's hot water heater.



Reclaim waste heat while increasing unit EER's!

New Trane desuperheaters put your air conditioner's waste heat to work while increasing your unit's efficiency by up to 12 percent! Saving you valuable energy dollars two ways—with a payback period as low as one year!

PROVIDING 'FREE' HOT WATER

Trane desuperheaters save energy by recovering waste heat normally rejected by your air conditioner and using it to heat domestic or process water. This adds up to significant energy savings when considering that a typical 40-ton air-cooled system can generate 192 gallons of hot water per hour! Assuming that 40 tons is a continuous average load and the electrical rate is 5¢ per kwh, the Trane desuperheater can save you $37 per day. That's $4,440 for 120 days of operation!

CALCULATE YOUR SAVINGS

The following table estimates the maximum number of gallons of hot water the new Trane desuperheater can produce. The gallons shown are based on ARI* standards for temperature rises of 75 F to 140 F and 115 F to 140 F.

Air Conditioning Unit Size at Full Load	GPM/GPH 75-140° Temperature Rise	BTU/HR SAVED	GPM/GPH 115-140° Temperature Rise	BTU/HR SAVED
10	0.8/48	26,000	1.9/114	23,750
20	1.6/96	52,000	3.8/228	47,500
30	2.4/144	78,000	5.7/342	71,250
40	3.2/192	104,000	7.6/456	95,000
50	4.0/240	130,000	9.5/570	118,750
60	4.8/288	156,000	11.4/684	142,500
70	5.6/336	182,000	13.3/798	166,250
80	6.4/384	208,000	15.2/912	190,000
90	7.2/432	234,000	17.1/1026	213,750
100	8.0/480	260,000	19.0/1140	237,500

* 1980 Air Conditioning and Refrigeration Institute Standard 470 for desuperheater/water heaters.

To estimate your savings:

1) Reference the above table and multiply the number of gallons of hot water per hour which can be generated by your air conditioning unit by the number of hours of unit operation per day. Enter the nomograph at point A with this value.
2) Next, follow a horizontal line across the desuperheater savings nomograph to the water temperature rise desired.

$$\text{Water Temperature Rise } (\Delta Tw) = \text{Desired Temperature of Water Leaving the Desuperheater (LWT)} - \text{Temperature Water Entering the Desuperheater (EWT)}$$

3) To calculate the value of 100,000 Btu of reclaimed heat you can obtain, use the following formula:

$$\text{Value (\$) per 100,000 Btu} = \frac{\text{fuel cost per unit}}{\text{combustion efficiency} \times \text{heat content per unit}} \times 100{,}000 \text{ Btu}$$

Once you have calculated your cost of fuel per 100,000 Btu's, drop vertically from point B to your calculated value at point C.

4) Your estimated savings in dollars per day can now be found by moving horizontally to the left on the nomograph to point D.
5) Take the savings obtained from step 4 and insert it into the following formula:

$$\text{Total Cost Savings} = \frac{\text{Dollars}}{\text{Day}} \times \frac{\text{Operating Days}^{**}}{\text{Year}} = \frac{\text{Dollars}}{\text{Year}}$$

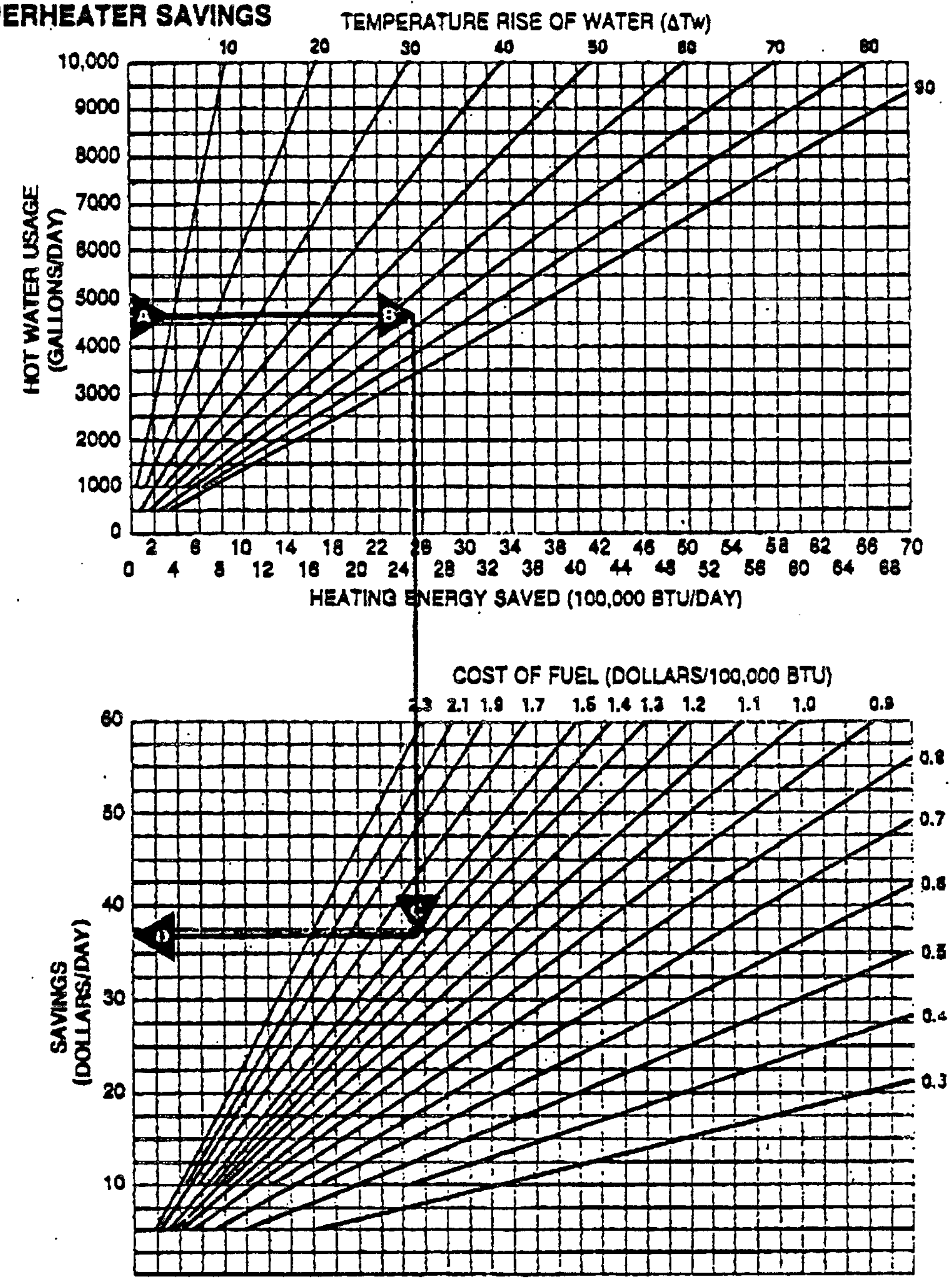
** This number is the expected amount of days the air conditioner will run and heat can be reclaimed.

The following are average unit prices and heating values of several common fuels:

Fuel	Unit Price*	Heat Content	Efficiency	Cost/100,000 BTU*
Electricity	$0.05/kwh	3,413 Btu/kwh	100%	$1.47
#2 Fuel Oil	1.20/gallon	140,000 Btu/gallon	75%	1.14
Natural Gas	0.38/therm	100,000 Btu/therm	80%	0.48
Propane	0.80/gallon	92,000 Btu/gallon	80%	1.10

* Unit prices and cost/100,000 BTU will vary depending on your location.

ANNUAL DESUPERHEATER SAVINGS



EXAMPLE:

1. A 40-ton unit operating at full capacity can generate 192 gallons of hot water per hour when heated from 75 F to 140 F. This is equal to 4,608 gallons per day. Locate 4,608 gallons per day on the nomograph (point A).
2. The ΔT_w is 140 F − 75 F = 65 F. Follow the horizontal line at 4,608 gallons per day across to 65 F T_w (point B).
3. Drop vertically to the lower section of the nomograph to the cost per 100,000 Btu. In this case let's use an electric water heater at $0.05 per kwh to yield a cost of $1.47 per 100,000 Btu (point C).
4. Run horizontally to the left to $37/day savings (point D).
5. If this air conditioning unit operated at full capacity for 120 days per year, the desuperheater would provide the following yearly savings:

$$\frac{\$37}{\text{day}} \times 120 \text{ operating days/year} = \frac{\$4,440}{\text{year}}$$

Depending on the installation, this savings could result in a payback period as low as one year!

UP TO 12% HIGHER OPERATING EFFICIENCIES

But the energy savings derived from Trane desuperheaters continue beyond 'free' hot water. Desuperheaters also deliver increased unit efficiency.

Desuperheaters remove heat from the discharge gas before it reaches the condenser coil. This allows the condenser to work more efficiently and, in turn, allows your air conditioner to provide more cooling with the same amount of energy or less. Increasing your total unit operating efficiency by up to 12 percent!

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**                                                                          **
**            T R A C E    6 0 0    A N A L Y S I S                        **
**                                                                          **
**            by              **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO Central Chiller Plant with Waste Heat Recovery

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 5:50 3/13/92
Dataset Name: 300 .TM

System 1 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak					Clg Space Peak		Heating Coil Peak		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,734		12,734	2.70	0	0.00	0	-13,550	3.56
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	81,136	27,781		108,917	23.06	81,117	28.85	-128,969	-173,237	45.46
Partition	-4,965			-4,965	-1.05	-4,965	-1.77	-60,134	-60,134	15.78
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	6,185			6,185	1.31	7,886	2.80	-14,848	-14,848	3.90
Sub Total==>	82,355	40,515		122,871	26.01	84,038	29.88	-203,952	-261,770	68.69
Internal Loads										
Lights	60,341	0		60,341	12.77	60,341	21.46	0	0	0.00
People	27,300			27,300	5.78	14,950	5.32	0	0	0.00
Misc	103,877	0	0	103,877	21.99	103,877	36.94	0	0	0.00
Sub Total==>	191,518	0	0	191,518	40.54	179,168	63.71	0	0	0.00
Ceiling Load	3,991	-3,991		0	0.00	3,230	1.15	-4,628	0	0.00
Outside Air	0	0	0	62,240	13.18	0	0.00	0	-149,417	39.21
Sup. Fan Heat				84,211	17.83		0.00		84,211	-22.10
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	14,770			14,770	3.13	14,770	5.25	-58,220	-58,220	15.28
Exhaust Heat		-3,250	0	-3,250	-0.69		0.00		4,116	-1.08
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	292,634	33,274	0	472,359	100.00	281,206	100.00	-266,799	-381,080	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity		Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR		
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains
Main Clg	39.4	472.4	478.2	46,440	74.7	58.0	56.8	63.8	54.1	57.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.4	472.4								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

-----------HEATING COIL SELECTION------------

	Capacity	Coil Airfl	Ent	Lvg
	(Mbh)	(cfm)	Deg F	Deg F
Main Htg	-340.6	46,440	70.3	78.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	46,440	67.4	63.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-340.6			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	3,251	3,251
Infil	323	323
Supply	46,440	46,440
Mincfm	0	0
Return	46,440	46,440
Exhaust	3,251	3,251
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.85
Clg Cfm/Ton	1179.78
Clg Sqft/Ton	306.51
Clg Btuh/Sqft	39.15
No. People	65
Htg % OA	7.0
Htg Cfm/SqFt	3.85
Htg Btuh/SqFt	-28.23

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.7	78.0
Plenum	73.0	70.5
Return	73.0	70.7
Ret/OA	74.7	67.4
Runarnd	72.0	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

System 2 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,709		12,709	2.03	0	0.00	0	-13,608	4.14
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	72,716	24,577		97,293	15.58	72,716	16.75	-124,832	-167,314	50.84
Partition	-5,411			-5,411	-0.87	-5,411	-1.25	-64,928	-64,928	19.73
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	7,121			7,121	1.14	7,885	1.82	-14,848	-14,848	4.51
Sub Total==>	74,427	37,286		111,713	17.89	75,191	17.32	-204,608	-260,698	79.22
Internal Loads										
Lights	73,523	0		73,523	11.77	73,523	16.93	0	0	0.00
People	19,740			19,740	3.16	10,810	2.49	0	0	0.00
Misc	266,323	0	0	266,323	42.64	266,323	61.34	0	0	0.00
Sub Total==>	359,585	0	0	359,585	57.57	350,655	80.76	0	0	0.00
Ceiling Load	4,319	-4,319		0	0.00	3,459	0.80	-5,209	0	0.00
Outside Air	0	0	0	60,882	9.75	0	0.00	0	-126,942	38.58
Sup. Fan Heat				90,495	14.49		0.00		90,495	-27.50
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	4,876			4,876	0.78	4,876	1.12	-35,774	-35,774	10.87
Exhaust Heat		-2,988	0	-2,988	-0.48		0.00		3,851	-1.17
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	443,207	29,979	0	624,563	100.00	434,181	100.00	-245,591	-329,069	100.00

---------------------------------COOLING COIL SELECTION---------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	52.0	624.6	622.4	39,460	74.8	57.0	52.4	58.1	50.8	52.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	52.0	624.6								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

-----------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	39,460	67.4	78.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	39,460	67.3	58.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-420.2			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,762	2,762
Infil	323	323
Supply	39,460	39,460
Mincfm	0	0
Return	39,460	39,460
Exhaust	2,762	2,762
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.27
Clg Cfm/Ton	758.16
Clg Sqft/Ton	231.81
Clg Btuh/Sqft	51.77
No. People	47
Htg % OA	7.0
Htg Cfm/SqFt	3.27
Htg Btuh/SqFt	-34.83

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.5	78.5
Plenum	73.1	70.4
Return	73.1	70.5
Ret/OA	74.8	67.3
Runarnd	72.0	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	41,022		41,022	2.65	0	0.00	0	-43,963	5.50
Glass Solar	14,028	0		14,028	0.91	40,581	4.51	0	0	0.00
Glass Cond	8,239	0		8,239	0.53	5,819	0.65	-16,967	-16,967	2.12
Wall Cond	147,401	52,964		200,366	12.94	135,487	15.06	-266,726	-361,665	45.23
Partition	-12,991			-12,991	-0.84	-12,991	-1.44	-149,871	-149,871	18.74
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	20,007			20,007	1.29	23,124	2.57	-45,361	-45,361	5.67
Sub Total==>	176,683	93,986		270,670	17.48	192,019	21.34	-478,926	-617,828	77.27
Internal Loads										
Lights	238,645	0		238,645	15.41	238,645	26.52	0	0	0.00
People	64,680			64,680	4.18	35,420	3.94	0	0	0.00
Misc	425,318	0	0	425,318	27.47	425,318	47.27	3,208	3,208	-0.40
Sub Total==>	728,643	0	0	728,643	47.06	699,382	77.72	3,208	3,208	-0.40
Ceiling Load	7,657	-7,657		0	0.00	7,258	0.81	-11,689	0	0.00
Outside Air	0	0	0	189,859	12.26	0	0.00	0	-430,464	53.84
Sup. Fan Heat				363,958	23.51		0.00		363,958	-45.52
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	1,182			1,182	0.08	1,182	0.13	-127,578	-127,578	15.96
Exhaust Heat		-5,903	0	-5,903	-0.38		0.00		9,137	-1.14
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	914,165	80,427	0	1,548,408	100.00	899,842	100.00	-614,985	-799,567	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	129.0	1,548.4	1,560.1	133,808	74.4	57.5	55.1	62.1	53.0	55.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	129.0	1,548.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	133,808	67.3	76.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	133,808	67.7	62.1
Reheat	0.0	0	0.0	0.0
Humidif	-439.3	10,353	4.7	75.1
Opt Vent	0.0	0	0.0	0.0
Total	-1,658.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	9,366	9,366
Infil	987	987
Supply	133,808	133,808
Mincfm	0	0
Return	133,808	133,808
Exhaust	9,366	9,366
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.64
Clg Cfm/Ton	1037.00
Clg Sqft/Ton	284.50
Clg Btuh/Sqft	42.18
No. People	154
Htg % OA	7.0
Htg Cfm/SqFt	3.64
Htg Btuh/SqFt	-33.21

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.0	76.8
Plenum	72.7	70.9
Return	72.7	71.0
Ret/OA	74.4	67.7
Runarnd	72.0	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

-------------------------------- B U I L D I N G U - V A L U E S --------------------------------

		Room U-Values (Btu/hr/sqft/F)									Room	Room
Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Mass (lb/ sqft)	Capac. (Btu/ sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3 96	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 300

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	Z1-BSAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0		0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 300

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
Design Load	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	0
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725,737	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	0
35 - 40	88.2	9	801	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 WASTE HEAT RECOVERY : P300

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	368,708	674	720	58	5
Feb	334,316	674	431	63	4
March	377,302	674	0	149	0
April	367,838	698	0	222	0
May	395,164	721	0	321	0
June	396,753	740	0	381	0
July	412,540	750	0	416	0
Aug	414,839	744	0	403	0
Sept	381,228	722	0	317	0
Oct	385,657	706	0	241	0
Nov	362,310	674	0	137	0
Dec	368,714	680	94	80	2
Total	4,565,370	750	1,245	2,788	5

Building Energy Consumption = 258,153 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 258,216 (Btu/Sq Ft/Year)

Σ monthly KW = 8,457

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

--------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S ---------------------------------------

Utility ELECTRIC DEMAND

Peak Value 749.9 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	85.1	11.35
2	EQ1001S	2-STG CTV <555 TONS	118.0	15.74
Sub Total			203.2	27.09
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	6.47
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.48
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	15.92
Sub Total			201.4	26.86
Sub Total			0.0	0.00
Miscellaneous				
Lights			109.1	14.55
Base Utilities			0.0	0.00
Misc Equipment			236.2	31.49
Sub Total			345.3	46.05
Grand Total			749.9	100.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 300 - DRY-BULB ECONOMIZERS WITH DDC CONTROLS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	07/07/92	ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=	$149,536		
B. SIOH COST	(5.5% of 1A) =	$8,224		
C. DESIGN COST	(6.0% of 1A) =	$8,972		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$166,733		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	---------->	$166,733	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	1,346	$8,714	10.79	$94,026	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	(2,144)	($4,743)	12.38	($58,723)	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		(798)	3,970.8		---------->	$35,303

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELECT. DEMAND SAVINGS) = $7,196

1 DISCOUNT FACTOR (From Table A-2) = 10.67

2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $76,776

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $76,776

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $11,650

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.28

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$11,166
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$112,079
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.67
7	SIMPLE PAYBACK (SPB)	(1F/4) =	14.93

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): DRY-BULB ECONOMIZERS ON AHUs with DDC CONTROLS - BLDG. 300	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
	RETURN AIR, OUTSIDE AIR, & MIXED AIR SENSORS	EA	13	164.00	2132	1.80	27.60	645.84		$2,777.84
	CONSTANT AVG. DUCT TEMP. SENSOR	EA	6	200.20	1201.2	2.00	27.60	331.20		$1,532.40
	SPACE TEMPERATURE SENSORS	EA	20	153.00	3060.00	1.50	27.60	828.00		$3,888.00
	DIFF. PRESSURE SWITCH - AIR	EA	6	38.80	232.80	0.50	27.60	82.80		$315.60
	E / P TRANSDUCERS	EA	12	87.5	1050.00	1	27.60	331.20		$1,381.20
	PNEUMATIC TUBING	LF	200	0.70	140.00	0.09	35.81	651.74		$791.74
	CONDUIT - 3/4" EMT w/ WIRE	LF	1500	0.48	715.5	0.06	27.60	2566.80		$3,282.30
	PROGRAMMABLE LOGIC CONTROLLER	EA	6	270.00	1620.00	2.0	27.60	331.20		$1,951.20
	CONTROL RELAY BASE / HOA	EA	6	51.20	307.20	2.0	27.60	331.20		$638.40
	REMOTE CONTROL UNIT	EA	6	1125	6750.00	8.0	27.60	1324.80		$8,074.80
	HAND-HELD TERMINAL	EA	1	1750	1750.00	1.5	50.00	75.00		$1,825.00
	CONTROL PROGRAMMING	EA	3			6.0	50.00	900.00		$900.00
	FIELD TEST OF CONTROL SYSTEM	EA	3			6.0	27.60	496.80		$496.80
	REFURBISH DAMPERS & DAMPER ACTUATOR	EA	6	75	450.00	4	35.81	859.44		$1,309.44
	SUBTOTAL THIS SHEET									$29,164.72

Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR	ADDRESS	
EMC ENGINEERS INC.	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	
CONTRACT FOR (Work to be performed): DRY-BULB ECONOMIZERS ON AHUs with DDC CONTROLS – BLDG. 300		PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:	WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	DEMOLITION									
	REMOVE CONCRETE BLOCK AND BRICK WALL	SF	384	2.55	979.20	0.69	20.58	5425.22		$6,404.42
	DISPOSAL OF CONSTRUCTION DEBRIS	CY	14.4	14.88	214.20	1.14	20.58	337.10		$551.30
	REMOVE DUCTWORK	EA	3			11.88	20.58	733.16		$733.16
	ROOF OPENING	EA	63	2.625	165.38	0.2	20.58	259.31		$424.68
	NEW HVAC DUCTWORK AND DAMPERS									
	GALVANIZED STEEL DUCTWORK	LBS	10800	0.66	7155	0.10	27.63	29430.09		$36,585.09
	RELIEF AIR VENT ON ROOF	EA	3	9100	27300.00	28.1	27.63	2331.28		$29,631.28
	DAMPERS W/ ACTUATOR (RA & EXH. AIR)	EA	6	625.0	3750.00	4.0	27.63	667.47		$4,417.47
	O.A. LOUVER, DAMPER W/ ACTUATOR	SF	384	56.5	21705.60	0.4	27.63	4668.36		$26,373.96
	CURB	LF	54	1.39	74.93	0.04	27.63	65.28		$140.20
	CUTTING, PATCHING, BRACING, DUST PROTECTION, MISC.	EA	1	1680.0	1680.00	90.00	27.63	2486.70		$4,166.70
	CONTINGENCY (10%)									$10,943
	SUBTOTAL									$120,371
	TOTAL									$149,536

Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

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**              T R A C E    6 0 0    A N A L Y S I S                      **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO (ECONOMIZERS W/ DISCRIMINATOR CONTROLS)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 22:11:59 6/18/92
Dataset Name: 300EC .TM

System 1 Block DD - DOUBLE DUCT

************************ COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>	Mo/Hr: 7/16	*	Mo/Hr: 7/16	*	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0	*	OADB: 97	*	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	12,734		12,734	2.70	*	0	0.00	*	0	-13,550	3.56
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	81,136	27,781		108,917	23.06	*	81,117	28.85	*	-128,969	-173,237	45.46
Partition	-4,965			-4,965	-1.05	*	-4,965	-1.77	*	-60,134	-60,134	15.78
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	6,185			6,185	1.31	*	7,886	2.80	*	-14,848	-14,848	3.90
Sub Total==>	82,355	40,515		122,871	26.01	*	84,038	29.88	*	-203,952	-261,770	68.69
Internal Loads						*			*			
Lights	60,341	0		60,341	12.77	*	60,341	21.46	*	0	0	0.00
People	27,300			27,300	5.78	*	14,950	5.32	*	0	0	0.00
Misc	103,877	0	0	103,877	21.99	*	103,877	36.94	*	0	0	0.00
Sub Total==>	191,518	0	0	191,518	40.54	*	179,168	63.71	*	0	0	0.00
Ceiling Load	3,991	-3,991		0	0.00	*	3,230	1.15	*	-4,628	0	0.00
Outside Air	0	0	0	62,240	13.18	*	0	0.00	*	0	-149,417	39.21
Sup. Fan Heat				84,211	17.83	*		0.00	*		84,211	-22.10
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	14,770			14,770	3.13	*	14,770	5.25	*	-58,220	-58,220	15.28
Exhaust Heat		-3,250	0	-3,250	-0.69	*		0.00	*		4,116	-1.08
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
Grand Total==>	292,634	33,274	0	472,359	100.00	*	281,206	100.00	*	-266,799	-381,080	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	39.4	472.4	478.2	46,440	74.7	58.0	56.8	63.8	54.1	57.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.4	472.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-340.6	46,440	70.3	78.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	46,440	67.4	63.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-340.6			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	3,251	3,251
Infil	323	323
Supply	46,440	46,440
Mincfm	0	0
Return	46,440	46,440
Exhaust	3,251	3,251
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.85
Clg Cfm/Ton	1179.78
Clg Sqft/Ton	306.51
Clg Btuh/Sqft	39.15
No. People	65
Htg % OA	7.0
Htg Cfm/SqFt	3.85
Htg Btuh/SqFt	-28.23

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.7	78.0
Plenum	73.0	70.5
Return	73.0	70.7
Ret/OA	74.7	67.4
Runarnd	72.0	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

System 2 Block DD - DOUBLE DUCT

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,709		12,709	2.03	0	0.00	0	-13,608	4.14
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	72,716	24,577		97,293	15.58	72,716	16.75	-124,832	-167,314	50.84
Partition	-5,411			-5,411	-0.87	-5,411	-1.25	-64,928	-64,928	19.73
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	7,121			7,121	1.14	7,885	1.82	-14,848	-14,848	4.51
Sub Total==>	74,427	37,286		111,713	17.89	75,191	17.32	-204,608	-260,698	79.22
Internal Loads										
Lights	73,523	0		73,523	11.77	73,523	16.93	0	0	0.00
People	19,740			19,740	3.16	10,810	2.49	0	0	0.00
Misc	266,323	0	0	266,323	42.64	266,323	61.34	0	0	0.00
Sub Total==>	359,585	0	0	359,585	57.57	350,655	80.76	0	0	0.00
Ceiling Load	4,319	-4,319		0	0.00	3,459	0.80	-5,209	0	0.00
Outside Air	0	0	0	60,882	9.75	0	0.00	0	-126,942	38.58
Sup. Fan Heat				90,495	14.49		0.00		90,495	-27.50
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	4,876			4,876	0.78	4,876	1.12	-35,774	-35,774	10.87
Exhaust Heat		-2,988	0	-2,988	-0.48		0.00		3,851	-1.17
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	443,207	29,979	0	624,563	100.00	434,181	100.00	-245,591	-329,069	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	52.0	624.6	622.4	39,460	74.8	57.0	52.4	58.1	50.8	52.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	52.0	624.6								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	39,460	67.4	78.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	39,460	67.3	58.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-420.2			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	2,762	2,762
Infil	323	323
Supply	39,460	39,460
Mincfm	0	0
Return	39,460	39,460
Exhaust	2,762	2,762
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	7.0
Clg Cfm/Sqft	3.27
Clg Cfm/Ton	758.16
Clg Sqft/Ton	231.81
Clg Btuh/Sqft	51.77
No. People	47
Htg % OA	7.0
Htg Cfm/SqFt	3.27
Htg Btuh/SqFt	-34.83

TEMPERATURES (F)

Type	Clg	Htg
SADB	60.5	78.5
Plenum	73.1	70.4
Return	73.1	70.5
Ret/OA	74.8	67.3
Runarnd	72.0	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	41,022		41,022	2.65	*	0	0.00	*	0	-43,963	5.50
Glass Solar	14,028	0		14,028	0.91	*	40,581	4.51	*	0	0	0.00
Glass Cond	8,239	0		8,239	0.53	*	5,819	0.65	*	-16,967	-16,967	2.12
Wall Cond	147,401	52,964		200,366	12.94	*	135,487	15.06	*	-266,726	-361,665	45.23
Partition	-12,991			-12,991	-0.84	*	-12,991	-1.44	*	-149,871	-149,871	18.74
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	20,007			20,007	1.29	*	23,124	2.57	*	-45,361	-45,361	5.67
Sub Total==>	176,683	93,986		270,670	17.48	*	192,019	21.34	*	-478,926	-617,828	77.27
Internal Loads						*			*			
Lights	238,645	0		238,645	15.41	*	238,645	26.52	*	0	0	0.00
People	64,680			64,680	4.18	*	35,420	3.94	*	0	0	0.00
Misc	425,318	0	0	425,318	27.47	*	425,318	47.27	*	3,208	3,208	-0.40
Sub Total==>	728,643	0	0	728,643	47.06	*	699,382	77.72	*	3,208	3,208	-0.40
Ceiling Load	7,657	-7,657		0	0.00	*	7,258	0.81	*	-11,689	0	0.00
Outside Air	0	0	0	189,859	12.26	*	0	0.00	*	0	-430,464	53.84
Sup. Fan Heat				363,958	23.51	*		0.00	*		363,958	-45.52
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	1,182			1,182	0.08	*	1,182	0.13	*	-127,578	-127,578	15.96
Exhaust Heat		-5,903	0	-5,903	-0.38	*		0.00	*		9,137	-1.14
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
Grand Total==>	914,165	80,427	0	1,548,408	100.00	*	899,842	100.00	*	-614,985	-799,567	100.00

---COOLING COIL SELECTION---

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	129.0	1,548.4	1,560.1	133,808	74.4	57.5	55.1	62.1	53.0	55.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	129.0	1,548.4								

---AREAS---

	Gross Total	Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

---HEATING COIL SELECTION---

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	133,808	67.3	76.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	133,808	67.7	62.1
Reheat	0.0	0	0.0	0.0
Humidif	-439.3	10,353	4.7	75.1
Opt Vent	0.0	0	0.0	0.0
Total	-1,658.3			

---AIRFLOWS (cfm)---

Type	Cooling	Heating
Vent	9,366	9,366
Infil	987	987
Supply	133,808	133,808
Mincfm	0	0
Return	133,808	133,808
Exhaust	9,366	9,366
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.64
Clg Cfm/Ton	1037.00
Clg Sqft/Ton	284.50
Clg Btuh/Sqft	42.18
No. People	154
Htg % OA	7.0
Htg Cfm/SqFt	3.64
Htg Btuh/SqFt	-33.21

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.0	76.8
Plenum	72.7	70.9
Return	72.7	71.0
Ret/OA	74.4	67.7
Runarnd	72.0	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 3
ECO - ECONOMIZERS ON AHUS - BUILDING 300

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 3
ECO - ECONOMIZERS ON AHUS - BUILDING 300

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	Z1-BSMT EAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0	0	0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3
ECO - ECONOMIZERS ON AHUS - BUILDING 300

S Y S T E M   L O A D   P R O F I L E

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	11.0	12	574	-120,956	34	2,665	10,985.4	0	0	0.0	0	0
5 - 10	22.0	3	146	-241,912	3	201	21,970.8	0	0	0.0	0	0
10 - 15	33.1	1	63	-362,869	2	155	32,956.2	0	0	0.0	0	0
15 - 20	44.1	4	178	-483,825	6	454	43,941.6	0	0	0.0	0	0
20 - 25	55.1	1	61	-604,781	38	2,983	54,927.0	0	0	0.0	0	0
25 - 30	66.1	3	140	-725,737	18	1,423	65,912.4	0	0	0.0	0	0
30 - 35	77.2	1	69	-846,693	0	0	76,897.8	0	0	0.0	0	0
35 - 40	88.2	4	173	-967,650	0	0	87,883.2	0	0	0.0	0	0
40 - 45	99.2	4	168	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	6	268	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	12	547	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	11	535	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	10	496	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	9	445	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	5	258	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	4	169	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	4	196	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	3	130	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	2	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	4,016	0	0	879	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	307,645	557	7,058	0	10
Feb	277,922	557	6,301	0	10
March	318,032	662	6,408	11	9
April	339,990	731	3,942	124	9
May	391,884	756	2,022	257	8
June	416,305	833	246	367	3
July	433,940	837	0	409	0
Aug	436,411	830	140	392	1
Sept	393,493	759	1,696	258	8
Oct	358,005	739	4,047	136	9
Nov	301,673	653	6,279	7	9
Dec	306,155	557	6,852	0	9
Total	4,281,456	837	44,991	1,961	10

Building Energy Consumption = 314,129 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 316,416 (Btu/Sq Ft/Year)

Σ Monthly KW = 8,471

UTILITY PEAK CHECKSUMS - ALTERNATIVE 3

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 837.1 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1001S	2-STG CTV <555 TONS	179.4	21.43
2	EQ1122L	AIR-CLD RECIP >55 TONS	111.1	13.27
Sub Total			290.4	34.69
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	5.79
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.01
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	14.26
Sub Total			201.4	24.06
Sub Total			0.0	0.00
Miscellaneous				
Lights			109.1	13.04
Base Utilities			0.0	0.00
Misc Equipment			236.2	28.21
Sub Total			345.3	41.25
Grand Total			837.1	100.00

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

JOB WSMR ESOS STUDY #1110-000

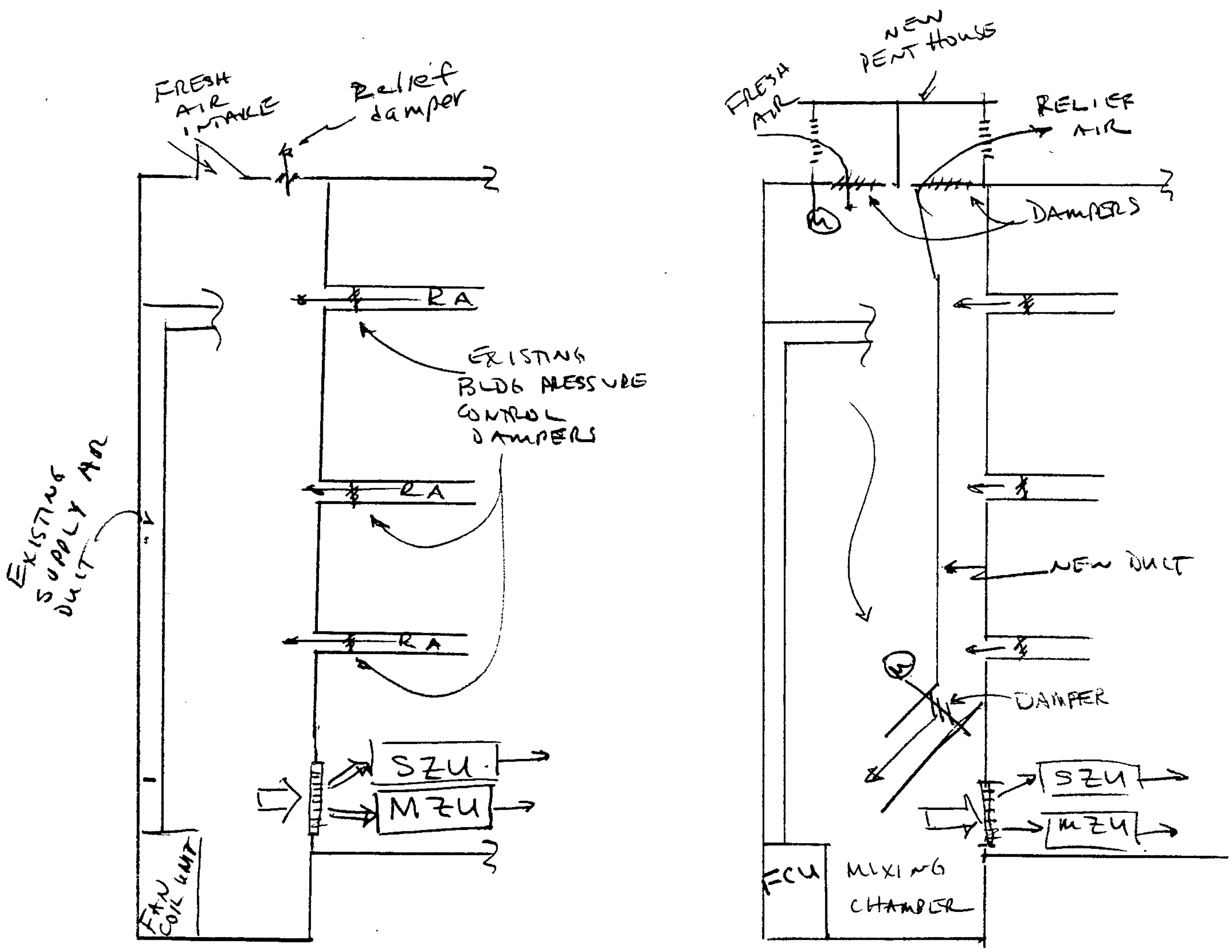
SHEET NO. 1 OF 2

CALCULATED BY T. Forster DATE 7/07/92

CHECKED BY C.B. DATE 7/07/92

SCALE None

P300 ECONOMIZER CONCEPT



EXISTING.
MAIN BLDG.

PROPOSED.
MAIN BLDG.

EAST & WEST WINGS ARE SIMILAR AS TO CONCEPT APPLICATION.

JOB WSMR 1110.000

SHEET NO. 2 OF 2

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY C. Butler DATE 7-7-92

CHECKED BY ______ DATE ______

SCALE ______

COST ESTIMATE FOR 1 WING.

		MATL		LABOR		EQUIP		TOTAL
DEMOLITION:								
WALL (NOT REINF) 128 SF				11.30	1446	2.04	261	1708
LOAD & TRUCK (2 MI) 4.8 CY				18.75	90	11.90	57	147
DUCTWORK JOB.				195	195			195
ROOF 21 SF				3.28	69	2.10	44	113
NEW WORK								
GALV. STL DUCT. 3600 lb.		.53	1908	2.18	7848			9756
RELIEF VENT 1 EA		7280	7280	620	620			7900
O.B. DAMPER W/OPERATOR 2 EA		500	1000	89	178			1178
LOUVER, DAMPER & OPERATOR 128 SF.		45.22	5788	9.72	1244			7032
CURB 18 LF		1.11	20	.91	16.38	.04	.72	37
			15996		11,706			
FACTORS (FR/BELOW)	+	7%	1120	+12%	1405			
			17,116		13,111			$30,227 (BARE COST)

FACTORS.

	MATL	LABOR
CUT & PATCH EXIST.	2%	3%
DUST PROTECTION	1%	2%
PROT'N OF EXIST. WK.	2%	2%
TEMP. SHORING & BRAC'G	2%	5%
	7%	12%

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 300 - CENTRAL CHILLER PLANT WITH THERMAL STORAGE			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	10/26/92	ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST	=	$165,000		
B. SIOH COST	(5.5% of 1A) =	$9,075		
C. DESIGN COST	(6.0% of 1A) =	$9,900		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$183,975		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	————>	$183,975	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(224)	($1,453)	15.23	($22,122)	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		(224)	(1,452.5)		————>	($22,122)

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = $39,546

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $580,535

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. UTILITY REBATE - KW SHIFT	$54,788	1	0.96	$52,596
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$54,788			$52,596

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $633,132

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = ($7,300)

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = -0.16

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$40,285
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$611,010
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	3.32
7 SIMPLE PAYBACK (SPB)	(1F/4) =	4.6

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR	ADDRESS	
EMC ENGINEERS INC.	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	

CONTRACT FOR (Work to be performed)	PROPOSED TOTAL CONTRACT PRICE
EXISTING CHILLER PLANT WITH THERMAL STORAGE – BLDG 300	

PURCHASE REQUEST NUMBER	PROJECT NUMBER	WORK LOCATION
		WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	EXSTNG CHILLER PLANT W/ THERMAL STORAGE									
	THERMAL STORAGE TANK & CONNECTIONS	EA	1	150000	150000	Material & Labor				$150,000
	CONTINGENCY (10%)									$15,000
	TOTAL THIS SHEET									$165,000

Source: EPRI Thermal Storage Applications Research Center, Material & Labor Costs Include 25% Overhead & Profit

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**              T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                         **
**              by              **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO EXISTING CHILLER PLANT W/ THERMAL STORAGE

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 5:50 3/13/92
Dataset Name: 300 .TM

System 1 Block DD - DOUBLE DUCT

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,734		12,734	2.70	0	0.00	0	-13,550	3.56
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	81,136	27,781		108,917	23.06	81,117	28.85	-128,969	-173,237	45.46
Partition	-4,965			-4,965	-1.05	-4,965	-1.77	-60,134	-60,134	15.78
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	6,185			6,185	1.31	7,886	2.80	-14,848	-14,848	3.90
Sub Total==>	82,355	40,515		122,871	26.01	84,038	29.88	-203,952	-261,770	68.69
Internal Loads										
Lights	60,341	0		60,341	12.77	60,341	21.46	0	0	0.00
People	27,300			27,300	5.78	14,950	5.32	0	0	0.00
Misc	103,877	0	0	103,877	21.99	103,877	36.94	0	0	0.00
Sub Total==>	191,518	0	0	191,518	40.54	179,168	63.71	0	0	0.00
Ceiling Load	3,991	-3,991		0	0.00	3,230	1.15	-4,628	0	0.00
Outside Air	0	0	0	62,240	13.18	0	0.00	0	-149,417	39.21
Sup. Fan Heat				84,211	17.83		0.00		84,211	-22.10
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	14,770			14,770	3.13	14,770	5.25	-58,220	-58,220	15.28
Exhaust Heat		-3,250	0	-3,250	-0.69		0.00		4,116	-1.08
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	292,634	33,274	0	472,359	100.00	281,206	100.00	-266,799	-381,080	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F (WB)	Entering Grains	Leaving Deg F	Leaving Deg F (WB)	Leaving Grains
Main Clg	39.4	472.4	478.2	46,440	74.7	58.0	56.8	63.8	54.1	57.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.4	472.4								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-340.6	46,440	70.3	78.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	46,440	67.4	63.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-340.6			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	3,251	3,251
Infil	323	323
Supply	46,440	46,440
Mincfm	0	0
Return	46,440	46,440
Exhaust	3,251	3,251
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	7.0
Clg Cfm/Sqft	3.85
Clg Cfm/Ton	1179.78
Clg Sqft/Ton	306.51
Clg Btuh/Sqft	39.15
No. People	65
Htg % OA	7.0
Htg Cfm/SqFt	3.85
Htg Btuh/SqFt	-28.23

TEMPERATURES (F)

Type	Clg	Htg
SADB	65.7	78.0
Plenum	73.0	70.5
Return	73.0	70.7
Ret/OA	74.7	67.4
Runarnd	72.0	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

System 2 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,709		12,709	2.03	0	0.00	0	-13,608	4.14
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	72,716	24,577		97,293	15.58	72,716	16.75	-124,832	-167,314	50.84
Partition	-5,411			-5,411	-0.87	-5,411	-1.25	-64,928	-64,928	19.73
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	7,121			7,121	1.14	7,885	1.82	-14,848	-14,848	4.51
Sub Total==>	74,427	37,286		111,713	17.89	75,191	17.32	-204,608	-260,698	79.22
Internal Loads										
Lights	73,523	0		73,523	11.77	73,523	16.93	0	0	0.00
People	19,740			19,740	3.16	10,810	2.49	0	0	0.00
Misc	266,323	0	0	266,323	42.64	266,323	61.34	0	0	0.00
Sub Total==>	359,585	0	0	359,585	57.57	350,655	80.76	0	0	0.00
Ceiling Load	4,319	-4,319		0	0.00	3,459	0.80	-5,209	0	0.00
Outside Air	0	0	0	60,882	9.75	0	0.00	0	-126,942	38.58
Sup. Fan Heat				90,495	14.49		0.00		90,495	-27.50
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	4,876			4,876	0.78	4,876	1.12	-35,774	-35,774	10.87
Exhaust Heat		-2,988	0	-2,988	-0.48		0.00		3,851	-1.17
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	443,207	29,979	0	624,563	100.00	434,181	100.00	-245,591	-329,069	100.00

---------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	52.0	624.6	622.4	39,460	74.8	57.0	52.4	58.1	50.8	52.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	52.0	624.6								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

-----------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	39,460	67.4	78.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	39,460	67.3	58.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-420.2			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,762	2,762
Infil	323	323
Supply	39,460	39,460
Mincfm	0	0
Return	39,460	39,460
Exhaust	2,762	2,762
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.27
Clg Cfm/Ton	758.16
Clg Sqft/Ton	231.81
Clg Btuh/Sqft	51.77
No. People	47
Htg % OA	7.0
Htg Cfm/SqFt	3.27
Htg Btuh/SqFt	-34.83

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.5	78.5
Plenum	73.1	70.4
Return	73.1	70.5
Ret/OA	74.8	67.3
Runarnd	72.0	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	41,022		41,022	2.65	0	0.00	0	-43,963	5.50
Glass Solar	14,028	0		14,028	0.91	40,581	4.51	0	0	0.00
Glass Cond	8,239	0		8,239	0.53	5,819	0.65	-16,967	-16,967	2.12
Wall Cond	147,401	52,964		200,366	12.94	135,487	15.06	-266,726	-361,665	45.23
Partition	-12,991			-12,991	-0.84	-12,991	-1.44	-149,871	-149,871	18.74
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	20,007			20,007	1.29	23,124	2.57	-45,361	-45,361	5.67
Sub Total==>	176,683	93,986		270,670	17.48	192,019	21.34	-478,926	-617,828	77.27
Internal Loads										
Lights	238,645	0		238,645	15.41	238,645	26.52	0	0	0.00
People	64,680			64,680	4.18	35,420	3.94	0	0	0.00
Misc	425,318	0	0	425,318	27.47	425,318	47.27	3,208	3,208	-0.40
Sub Total==>	728,643	0	0	728,643	47.06	699,382	77.72	3,208	3,208	-0.40
Ceiling Load	7,657	-7,657		0	0.00	7,258	0.81	-11,689	0	0.00
Outside Air	0	0	0	189,859	12.26	0	0.00	0	-430,464	53.84
Sup. Fan Heat				363,958	23.51		0.00		363,958	-45.52
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	1,182			1,182	0.08	1,182	0.13	-127,578	-127,578	15.96
Exhaust Heat		-5,903	0	-5,903	-0.38		0.00		9,137	-1.14
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	914,165	80,427	0	1,548,408	100.00	899,842	100.00	-614,985	-799,567	100.00

---------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	129.0	1,548.4	1,560.1	133,808	74.4	57.5	55.1	62.1	53.0	55.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	129.0	1,548.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

-----------HEATING COIL SELECTION-------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	133,808	67.3	76.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	133,808	67.7	62.1
Reheat	0.0	0	0.0	0.0
Humidif	-439.3	10,353	4.7	75.1
Opt Vent	0.0	0	0.0	0.0
Total	-1,658.3			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	9,366	9,366
Infil	987	987
Supply	133,808	133,808
Mincfm	0	0
Return	133,808	133,808
Exhaust	9,366	9,366
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.64
Clg Cfm/Ton	1037.00
Clg Sqft/Ton	284.50
Clg Btuh/Sqft	42.18
No. People	154
Htg % OA	7.0
Htg Cfm/SqFt	3.64
Htg Btuh/SqFt	-33.21

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.0	76.8
Plenum	72.7	70.9
Return	72.7	71.0
Ret/OA	74.4	67.7
Runarnd	72.0	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3 96	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 300

-- B U I L D I N G A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	Z1-BSAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0		0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 300

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	0
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725,737	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	0
35 - 40	88.2	9	801	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	368,811	707	6,458	121	14
Feb	334,023	707	5,227	111	14
March	380,280	706	2,512	147	8
April	378,364	705	585	189	3
May	416,460	728	9	252	0
June	430,028	748	0	288	0
July	446,446	754	0	310	0
Aug	447,660	749	0	303	0
Sept	407,210	733	0	252	0
Oct	397,986	712	782	201	4
Nov	364,146	704	2,815	141	9
Dec	370,091	709	5,163	128	11
Total	4,741,504	754	23,551	2,441	14

Building Energy Consumption = 304,696 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 305,893 (Btu/Sq Ft/Year)

Σ monthly kw = 8,662

COLD THERMAL STORAGE - ALTERNATIVE 1

----BUILDING COOLING DEMANDS AND THERMAL STORAGE----

January

Hour	Design OADB (F)	Design OAWB (F)	Design Cooling Load (Ton)	Design Chiller Load (Ton)	Design Chiller Demand (kW)	Design Storage Capacity (Ton-Hr)
1	32.8	22.9	51.0	51.0	43.2	2,000
2	31.5	21.9	47.8	47.8	41.6	2,000
3	30.4	20.9	45.2	45.2	40.3	2,000
4	29.6	20.4	43.4	43.4	39.5	2,000
5	29.4	20.0	41.6	41.6	38.6	2,000
6	29.9	20.7	39.8	39.8	37.7	2,000
7	31.2	22.0	38.2	38.2	36.9	2,000
8	33.6	24.0	40.7	0.0	0.0	1,959
9	37.0	26.5	52.6	0.0	0.0	1,907
10	40.9	28.5	57.9	0.0	0.0	1,849
11	45.4	30.7	64.7	0.0	0.0	1,784
12	49.6	34.1	71.8	0.0	0.0	1,712
13	52.7	36.1	76.0	0.0	0.0	1,636
14	54.8	36.7	80.3	0.0	0.0	1,556
15	55.6	37.2	84.6	0.0	0.0	1,471
16	54.8	36.8	88.5	0.0	0.0	1,383
17	53.0	35.6	73.8	0.0	0.0	1,309
18	50.1	34.0	66.4	0.0	0.0	1,243
19	46.7	31.7	62.1	290.7	265.0	1,471
20	43.3	29.9	57.1	290.7	265.0	1,705
21	40.4	28.1	54.6	290.7	265.0	1,941
22	37.8	26.4	52.2	111.2	86.6	2,000
23	35.7	24.9	49.5	49.5	42.5	2,000
24	34.1	23.9	47.1	47.1	41.3	2,000

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
1	36.9	28.0	44.7	44.7	40.1	2,000	45.3	45.3	40.4	2,000
2	34.1	25.7	43.6	43.6	39.5	2,000	44.2	44.2	39.8	2,000
3	31.6	23.5	42.3	42.3	38.9	2,000	42.9	42.9	39.2	2,000
4	29.5	21.9	41.3	41.3	38.4	2,000	41.8	41.8	38.7	2,000
5	28.0	20.5	40.1	40.1	37.8	2,000	40.7	40.7	38.1	2,000
6	27.0	20.1	38.9	38.9	37.2	2,000	39.5	39.5	37.5	2,000
7	26.7	20.4	38.1	38.1	36.9	2,000	38.7	38.7	37.2	2,000
8	27.3	21.4	40.4	0.0	0.0	1,960	37.8	0.0	0.0	1,962
9	29.2	23.1	50.9	0.0	0.0	1,909	37.3	0.0	0.0	1,925
10	32.1	24.4	55.1	0.0	0.0	1,854	36.8	0.0	0.0	1,888
11	35.8	26.3	60.4	0.0	0.0	1,793	36.5	0.0	0.0	1,852
12	39.8	28.8	65.6	0.0	0.0	1,728	36.6	0.0	0.0	1,815
13	43.9	31.5	68.6	0.0	0.0	1,659	36.9	0.0	0.0	1,778
14	47.5	33.8	72.1	0.0	0.0	1,587	37.5	0.0	0.0	1,741
15	50.4	35.9	75.7	0.0	0.0	1,511	38.2	0.0	0.0	1,702
16	52.3	37.3	78.9	0.0	0.0	1,432	39.3	0.0	0.0	1,663
17	52.9	37.7	64.6	0.0	0.0	1,368	40.8	0.0	0.0	1,622

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

COLD THERMAL STORAGE - ALTERNATIVE 1

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
18	52.6	37.9	56.9	0.0	0.0	1,311	42.5	0.0	0.0	1,580
19	51.6	38.7	53.2	290.7	265.0	1,548	44.3	290.7	265.0	1,826
20	50.1	38.3	48.9	290.7	265.0	1,790	45.5	219.4	186.6	2,000
21	48.0	37.0	47.7	257.6	229.1	2,000	46.4	46.4	40.9	2,000
22	45.5	35.2	47.2	47.2	41.3	2,000	46.0	46.0	40.7	2,000
23	42.7	32.9	46.6	46.6	41.0	2,000	45.6	45.6	40.5	2,000
24	39.8	30.3	45.5	45.5	40.5	2,000	45.1	45.1	40.3	2,000

Hour	Typical OADB (F)	Typical OAWB (F)	Sunday Cooling Load (Ton)	Sunday Chiller Load (Ton)	Sunday Chiller Demand (kW)	Sunday Storage Capacity (Ton-Hr)	Monday Cooling Load (Ton)	Monday Chiller Load (Ton)	Monday Chiller Demand (kW)	Monday Storage Capacity (Ton-Hr)
1	36.9	28.0	44.5	44.5	40.0	2,000	43.8	43.8	39.6	2,000
2	34.1	25.7	43.6	43.6	39.5	2,000	42.9	42.9	39.2	2,000
3	31.6	23.5	42.4	42.4	39.0	2,000	41.8	41.8	38.6	2,000
4	29.5	21.9	41.4	41.4	38.5	2,000	40.8	40.8	38.2	2,000
5	28.0	20.5	40.4	40.4	37.9	2,000	39.7	39.7	37.6	2,000
6	27.0	20.1	39.2	39.2	37.4	2,000	38.6	38.6	37.1	2,000
7	26.7	20.4	38.5	38.5	37.1	2,000	37.9	37.9	36.8	2,000
8	27.3	21.4	37.6	0.0	0.0	1,962	40.2	0.0	0.0	1,960
9	29.2	23.1	37.2	0.0	0.0	1,925	50.7	0.0	0.0	1,909
10	32.1	24.4	36.7	0.0	0.0	1,889	54.9	0.0	0.0	1,854
11	35.8	26.3	36.5	0.0	0.0	1,852	60.2	0.0	0.0	1,794
12	39.8	28.8	36.5	0.0	0.0	1,816	65.5	0.0	0.0	1,728
13	43.9	31.5	36.9	0.0	0.0	1,779	68.5	0.0	0.0	1,660
14	47.5	33.8	37.5	0.0	0.0	1,741	72.1	0.0	0.0	1,588
15	50.4	35.9	38.2	0.0	0.0	1,703	75.6	0.0	0.0	1,512
16	52.3	37.3	39.3	0.0	0.0	1,664	78.9	0.0	0.0	1,433
17	52.9	37.7	40.8	0.0	0.0	1,623	64.6	0.0	0.0	1,369
18	52.6	37.9	42.4	0.0	0.0	1,580	56.9	0.0	0.0	1,312
19	51.6	38.7	44.3	290.7	265.0	1,827	53.1	290.7	265.0	1,550
20	50.1	38.3	45.5	218.6	185.6	2,000	48.9	290.7	265.0	1,791
21	48.0	37.0	46.3	46.3	40.9	2,000	47.7	256.4	227.7	2,000
22	45.5	35.2	46.0	46.0	40.7	2,000	47.2	47.2	41.3	2,000
23	42.7	32.9	45.6	45.6	40.5	2,000	46.6	46.6	41.0	2,000
24	39.8	30.3	45.1	45.1	40.3	2,000	45.5	45.5	40.5	2,000

COLD THERMAL STORAGE - ALTERNATIVE 1

----BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

	Design		Design			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	79.1	56.4	131.8	290.7	281.4	1,201
2	78.0	55.8	126.7	290.7	278.8	1,365
3	77.2	55.5	122.2	290.7	277.1	1,533
4	76.5	55.1	118.1	290.7	275.5	1,706
5	76.3	55.9	115.2	290.7	275.9	1,881
6	76.7	56.8	113.6	232.4	212.4	2,000
7	77.8	57.7	113.1	113.1	80.7	2,000
8	79.8	57.9	123.5	0.0	0.0	1,877
9	82.6	59.0	155.0	0.0	0.0	1,722
10	85.8	60.3	168.9	0.0	0.0	1,553
11	89.5	61.3	184.8	0.0	0.0	1,368
12	93.0	62.7	198.6	0.0	0.0	1,169
13	95.6	63.5	205.4	0.0	0.0	964
14	97.3	63.9	211.3	0.0	0.0	753
15	98.0	64.0	215.7	0.0	0.0	537
16	97.3	63.6	217.4	0.0	0.0	319
17	95.8	62.6	196.2	0.0	0.0	123
18	93.4	61.3	179.2	56.0	46.6	0
19	90.6	60.1	169.6	290.7	306.0	121
20	87.8	58.5	158.8	290.7	299.1	253
21	85.4	57.9	153.2	290.7	294.2	390
22	83.2	57.5	148.5	290.7	289.8	533
23	81.5	57.3	143.2	290.7	286.6	680
24	80.2	56.9	137.7	290.7	283.9	833

	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	79.5	63.5	128.2	290.7	290.4	996	131.6	290.7	290.4	1,049
2	77.5	62.1	122.5	290.7	285.0	1,164	125.5	290.7	285.0	1,215
3	75.7	61.1	117.3	290.7	280.6	1,337	120.0	290.7	280.6	1,385
4	74.4	60.2	113.0	290.7	278.2	1,515	115.4	290.7	278.2	1,561
5	73.6	60.9	109.3	290.7	279.1	1,696	111.6	290.7	279.1	1,740
6	73.4	61.6	106.8	290.7	280.0	1,880	109.2	290.7	280.0	1,921
7	73.9	62.1	105.4	225.1	209.3	2,000	107.6	186.3	161.8	2,000
8	75.4	61.8	114.7	0.0	0.0	1,885	108.0	0.0	0.0	1,892
9	77.9	62.6	145.7	0.0	0.0	1,740	110.5	0.0	0.0	1,781
10	80.9	63.8	159.4	0.0	0.0	1,580	115.3	0.0	0.0	1,666
11	84.3	64.4	174.5	0.0	0.0	1,406	121.9	0.0	0.0	1,544
12	87.6	65.8	187.7	0.0	0.0	1,218	129.1	0.0	0.0	1,415
13	90.7	66.9	194.5	0.0	0.0	1,023	135.7	0.0	0.0	1,280
14	93.1	67.6	201.0	0.0	0.0	822	142.2	0.0	0.0	1,137
15	94.6	68.3	206.7	0.0	0.0	616	147.9	0.0	0.0	989
16	95.1	68.6	210.8	0.0	0.0	405	152.0	0.0	0.0	837
17	94.9	68.4	188.3	0.0	0.0	217	154.9	0.0	0.0	683

COLD THERMAL STORAGE - ALTERNATIVE 1

	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
18	94.1	67.9	173.4	0.0	0.0	43	155.9	0.0	0.0	527
19	92.8	67.8	166.1	290.7	320.2	168	157.1	290.7	320.2	660
20	91.0	66.7	155.4	290.7	315.4	303	154.9	290.7	315.4	796
21	89.0	66.7	150.3	290.7	311.8	443	151.8	290.7	311.8	935
22	86.7	66.5	146.8	290.7	307.4	587	148.3	290.7	307.4	1,077
23	84.3	66.1	142.4	290.7	302.6	736	143.9	290.7	302.6	1,224
24	81.8	65.0	136.1	290.7	296.6	890	137.6	290.7	296.6	1,377

	Typical		Sunday				Monday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	79.5	63.5	131.5	290.7	290.4	1,536	130.0	290.7	290.4	1,538
2	77.5	62.1	125.5	290.7	285.0	1,702	123.9	290.7	285.0	1,705
3	75.7	61.1	119.9	290.7	280.6	1,872	118.4	290.7	280.6	1,877
4	74.4	60.2	115.3	242.9	226.4	2,000	113.8	236.7	219.6	2,000
5	73.6	60.9	111.6	111.6	81.7	2,000	110.0	110.0	80.6	2,000
6	73.4	61.6	109.2	109.2	80.5	2,000	107.6	107.6	79.3	2,000
7	73.9	62.1	107.6	107.6	79.6	2,000	106.0	106.0	78.5	2,000
8	75.4	61.8	108.0	0.0	0.0	1,892	115.1	0.0	0.0	1,885
9	77.9	62.6	110.5	0.0	0.0	1,781	146.0	0.0	0.0	1,739
10	80.9	63.8	115.3	0.0	0.0	1,666	159.6	0.0	0.0	1,579
11	84.3	64.4	121.9	0.0	0.0	1,544	174.6	0.0	0.0	1,405
12	87.6	65.8	129.1	0.0	0.0	1,415	187.8	0.0	0.0	1,217
13	90.7	66.9	135.7	0.0	0.0	1,280	194.6	0.0	0.0	1,022
14	93.1	67.6	142.2	0.0	0.0	1,137	201.0	0.0	0.0	821
15	94.6	68.3	147.9	0.0	0.0	989	206.7	0.0	0.0	615
16	95.1	68.6	152.0	0.0	0.0	837	211.0	0.0	0.0	404
17	94.9	68.4	154.9	0.0	0.0	683	188.4	0.0	0.0	215
18	94.1	67.9	155.9	0.0	0.0	527	173.4	0.0	0.0	42
19	92.8	67.8	157.1	290.7	320.2	660	166.1	290.7	320.2	166
20	91.0	66.7	154.9	290.7	315.4	796	155.5	290.7	315.4	302
21	89.0	66.7	151.8	290.7	311.8	935	150.3	290.7	311.8	442
22	86.7	66.5	148.3	290.7	307.4	1,077	146.8	290.7	307.4	586
23	84.3	66.1	143.9	290.7	302.6	1,224	142.4	290.7	302.6	734
24	81.8	65.0	137.6	290.7	296.6	1,377	136.1	290.7	296.6	889

Thermal Energy Storage Systems

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Thermal Storage Technology Overview

Notes

Theoretical Storage Volume Requirements

Presently, these are three different types of media for storing thermal energy in a cool storage system: ice, salt hydrates and water. The first two undergo a change of phase while storing or releasing heat energy. The third, water, does not.

Each storage media requires some inherent volume and mass for storing heat energy. If one could neglect circulation space and assume 100% storage utilization, the theoretical storage volumes would be:

ice:	1.46 ft^3/ton-hour
salt hydrate:	3.18 ft^3/ton-hour
water:	9.62 ft^3/ton-hour

The figures shown for ice and salt storage are based upon latent heat capacity only. The figure for water is based upon a 20° change in storage temperature, from 40° to 60°.

These storage volumes are theoretical only. They are not obtainable in the field for several reasons. First, it is necessary to allocate some of the storage volume for internal circulation of fluid for heat transfer. While some manufacturers would like to have us believe otherwise, no thermal storage system is 100% efficient. Not all internal energy is completely usable. These factors result in actual storage volumes considerably above these figures. For example, these have become commonly accepted:

ice:	2.25 to 3.00 ft^3/ton-hour
salt hydrate:	5.50 to 6.00 ft^3/ton-hour
water:	12.50 to 13.00 ft^3/ton-hour

The lower value for ice storage represents a typical value for an encapsulated ice storage vessel; the higher value is for an ice harvester system.

Storage volumes often do not represent the actual storage "floor space" required. Many manufacturers build their systems in round or cylindrical tanks. In these cases, the required floor space is something above the "footprint" of a storage vessel, depending upon whether it is oriented in a horizontal or vertical configuration. Some amount of space is needed for access, however this often is quite minimal since very little if any servicing to the storage itself is ever needed. Some manufacturers' systems can be directly buried if the vessels are built to accommodate this.

Notes

Notes

were installed vertically, the space requirement would be about 0.063 ft^2/ton-hour. This is usually, as mentioned before, not possible unless the tank is outdoors. If installed horizontally, the storage vessel space requirement becomes 0.237 ft^2/ton-hour.

A normal required area range for vertical tanks is 0.063^2/ton-hour for a 45 ft high tank to 0.12^2 for a 25 high tank. Horizontal tanks will need an area of approximately 0.235 to 0.238 ft^2/ton hour.

Chilled Water Storage Systems

Chilled water storage systems are really nothing more than a tank of cold water held as close to 40° as possible. Why 40°? Because at this temperature, water is at its greatest density (this actually occurs at 39.2°, but 40° has become the standard minimum design temperature).

Many chilled water storage systems have been built. Extensive research has been done, and some very fine publications have come out of this effort, most notably that from EPRI. EPRI's publication EM 4852, <u>Stratified Chilled Water Storage Design Guide</u> is probably the most authoritative of all publications thus far. Research has proven that of all storage methods, a single stratified storage tank has the greatest reliability and at the lowest cost.

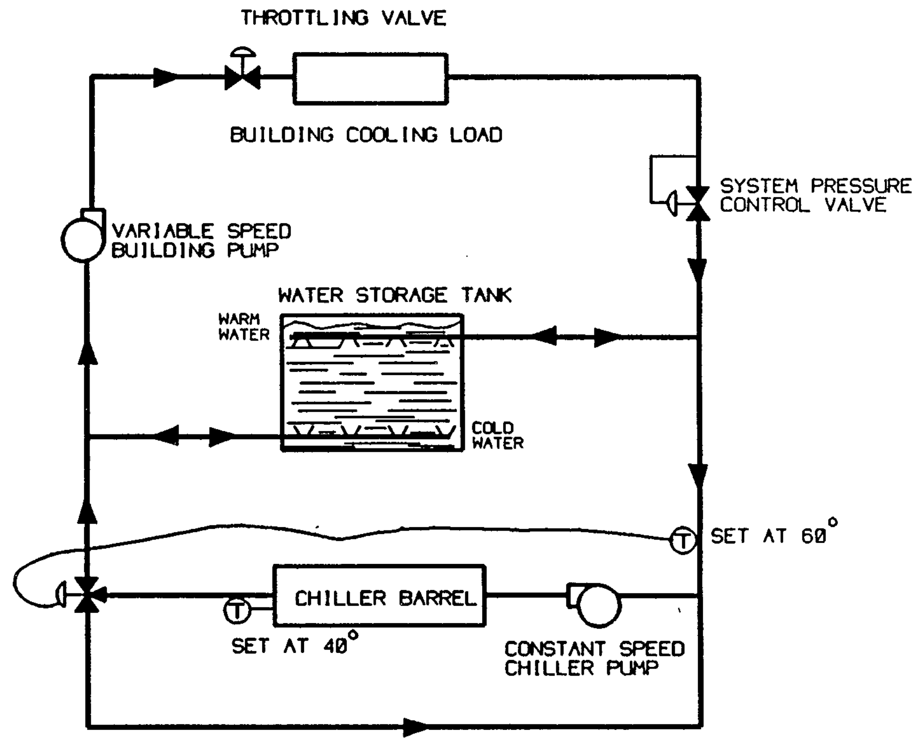
There is one important consideration about stratified water systems that one must keep in mind. Water returning from the building air-handling unit (cooling coil) MUST always return at a constant temperature (or very close to it). One may deduce from this statement that water flow rates are not constant, but variable. Hence this system would imply variable speed pumping. The only exception to this is the water flow circuit through the chiller itself, which is constant flow. Flow to the building is variable as is flow to the storage tank. Three-way valves on cooling coils cannot be used. If retrofitting an existing system, and it has three way valves, simply close off the bypass ports and cap them.

When retrofitting an existing air handling unit, check to see that it has a chilled water coil of at least 6 rows of tubing with 14 fins per inch. Eight rows are highly recommended. If the coil bank has less than 6 rows, add an additional cooling coil piped in series with the existing coil. If this is not possible, use another cool storage technology.

Manufacturers of stratified chilled water tanks are:

- CBI (Chicago Bridge & Iron Company - Stratatherm Div.)
- General Engineering Corp.
- Van Doren Industries

Notes



Notes

Space Requirements

The optimum storage tank for a stratified chilled water system is a round tank, no less than 12 feet deep. Depths greater than 12 ft are possible, but add little to the overall tank utilization efficiency. Because insulation of a water storage tank is so important, it is wise to design the tank so that total surface area is minimized while holding the minimum tank depth to 12 feet as mentioned before.

Based upon 6" of insulation on top and sides, a 12 ft depth and a 90% tank utilization, the required surface area will range between 1.043 ft^2 to 1.05 ft^2 per ton-hour. This area is for a rectangular tank.

Salt Hydrate Systems

This concept is quite similar to the encapsulated ice technology, except a higher temperature phase-change material (PCM) is used. (Note the used of the term "phase change material" - any substance that undergoes a change in its phase during the heat transfer process is a phase change material. For example, water meets this definition, when its goes from its liquid to solid phases. In so doing, its absorbs 144 btu/lb in the process.)

In a salt hydrate system, a proprietary salt mixture is used. Two types of salts, each having difference phase-change temperatures, can be selected as the storage medium. One freezes at 47°, the other at 41°.

Table 1

Demand & Energy of Thermal Storage Technologies(1)

	TO STORAGE				TO LOAD			
	PEAK DAY, kW/TON		SEASONAL, kWh/TON-HR		PEAK DAY, kW/TON		SEASONAL, kWh/TON-HR	
TECHNOLOGY	LO	HI	LO	HI	LO	HI	LO	HI
CHILLED WATER STORAGE[3]	1.00	1.10	0.75	0.95	0.95	1.05	0.65	0.95
SALT HYDRATE[3]	0.85	1.10	0.65	0.95	0.95	1.05	0.65	0.95
ICE HARVESTER[2]	0.95	1.50	0.80	1.10	0.75	0.95	0.50	0.95
B&R ICE[3][5]	1.00	1.60	0.95	1.25	0.95	1.05	0.65	0.80

(1) All figures include allowances for condenser or cooling tower fans, condenser and chilled water pump(s). "LO" figures are for evaporative-cooled equipment; "HI" figures are for water-cooled equipment. If air-cooled equipment is used, multiply ranges shown by 1.35.

(2) "LO" figures are for systems with refrigerant liquid overfeed, hi-side drainers and screw compressors with floating head pressure - see text.

(3) Water-cooled chillers, either reciprocating, screw or centrifugal, with constant condenser water inlet temperatures will exhibit values 1.5 to 2.5 times figures shown.

(4) On-peak demand for load shifting systems will range between 0.03 to 0.05 kW/ton for operation of chilled water pump(s).

(5) B&R Ice = Brine & Refrigerant Ice

Costs of Thermal Storage Systems

Notes

CONCEPT	$/TON-HOUR
chilled water	$60 - $85 (An average of $75^{00} is used.)
harvester	$125 - $145
salt hydrate	$100 - $120
brine/refg ice	$65 - $100

With the exception of the ice harvester, the balance of these concepts do not include cost for a refrigeration plant. The harvester does. The harvester system is a completely packaged unit and includes a storage tank.

All costs assume an "easy" installation, the storage system located immediately adjacent an outside equipment room wall.

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF 1

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY TF DATE 4/03/92

CHECKED BY DATE

SCALE

P300 THERMAL STORAGE ECO

DEMAND SHIFT CALCULATIONS

WITH TH. STORAGE, ALL CHILLER EQUIPMENT WILL OPERATE DURING THE OFF PEAK PERIOD EXCEPT THE CHILLED WATER PUMPS. FROM THE TRACE 600 THERMAL STORAGE COMPUTER REPORT, THE FOLLOWING KW LOADS WILL BE SHIFTED.

	kW (SUM OF MONTHLY DEMANDS)
2 STAGE CHILLER	1353.3
COOLING TOWER	225.7
COND. WATER PUMPS	134.4
CHILLER CONTROLS	12.3
AIR-COOLED CHILLER	304.4
CONTROLS	0.9
	2030.7 kW

AVERAGE MONTHLY kW SHIFT = $\frac{2030.7}{12}$ = 169 kW

ANNUAL DEMAND SAVINGS = 2030.7 × \$19.50 = \$39,599

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 300 - VARIABLE AIR VOLUME SYSTEMS ON AHUs FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 07/13/92 ECONOMIC LIFE: 15 PREPARED BY: A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=		$268,913	
B. SIOH COST	(5.5% of 1A) =		$14,790	
C. DESIGN COST	(6.0% of 1A) =		$16,135	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$299,838	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		------------->	$299,838

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	4,108	$26,597	10.79	$286,980	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	770	$1,704	12.38	$21,090	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		4,878	28,300.4		------------->	$308,070

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$21,333	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$227,623	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$227,623
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$101,663	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	1.37	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$49,633
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$535,693
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	1.79
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	6.04

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) VARIABLE AIR VOLUME SYSTEMS ON AHUs – BLDG 300	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER
	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	Main Building, West Addition, and East Addition									
	Remove Existing Mixing Boxes & Thermostats	EA	74			2.00	20.58	3045.84		$3,045.84
	Install Variable Frequency Drives – Main Bldg.	EA	3	14486	43458	50.00	27.60	4140.00		$47,598.00
	Install Variable Frequency Drives – West Addition	EA	2	5444	10888	40.00	27.60	2208.00		$13,096.00
	Install Variable Frequency Drives – East Addition	EA	2	7073	14145	40.00	27.60	2208.00		$16,353.00
	Install Balancing Dampers on SZ AHU ductwork	EA	12	64	768.75	6.00	27.60	1987.20		$2,755.95
	Dual Duct VAV Mixing Boxes	EA	74	563	41625	3.00	27.63	6133.86		$47,758.86
	VAV Box Controls: DDC Controllers	EA	74	449	33207.5	2.00	27.60	4084.80		$37,292.30
	Velocity Sensors	EA	74	125	9250	1.00	27.60	2042.40		$11,292.40
	VAV Box Actuators	EA	74	94	6937.5	1.00	27.60	2042.40		$8,979.90
	Space Temperature Sensors	EA	74	63	4625	1.00	27.60	2042.40		$6,667.40
	Sensor Wiring	LF	3700	0.31	1156.25	0.06	27.60	6127.20		$7,283.45
	Power Wiring & Conduit	LF	3700	0.71	2636.25	0.08	27.60	8169.60		$10,805.85
	Subtotal									$212,929

Source: Means Electric & Mechanical Cost Data, 1992; Denver Electric Motor Sales & Service; Material costs include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR
EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed)
VARIABLE AIR VOLUME SYSTEMS ON AHUs – BLDG 300

PROPOSED TOTAL CONTRACT PRICE

PURCHASE REQUEST NUMBER

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	Total (5)	LABOR COSTS Manhours Mandays (6)	Average Rate (7)	Total (8)	Other Direct Costs (9)	Line Total (10)
	Main Bldg, West Addition, and East Addition (cont')									
	AHU Controls: Remote Control Units	EA	7	1125	7875	8.00	27.60	1545.60		$9,420.60
	Pressure Sensor Wiring	LF	1400	0.31	437.5	0.08	27.60	3091.20		$3,528.70
	Pressure Sensors	EA	7	250	1750	2.00	27.60	386.40		$2,136.40
	Control Programming	EA	3			8.00	50.00	1200.00		$1,200.00
	Field Test of Control System	EA	3			8.00	27.63	663.12		$663.12
	Check Air Flow on AHUs	EA	7			12.00	27.63	2320.92		$2,320.92
	Check Max. and Min. Air Flow on VAV Boxes	EA	74			6.00	27.63	12267.72		$12,267.72
	Subtotal									$244,466
	Contingency (10%)									$24,447
	TOTAL									$268,913

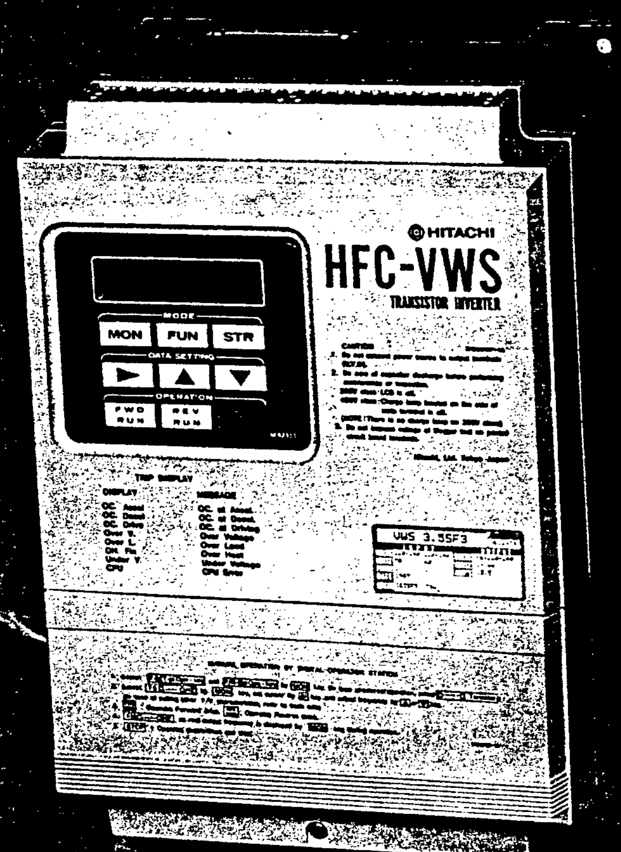
Source: Means Electric & Mechanical Cost Data, 1992; Denver Electric Motor Sales & Service; Material costs include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

HITACHI ADJUSTABLE FREQUENCY CONTROL

Rec'd 1/10/92
Anderson

HITACHI

HFC-VWS Series
LD3U, LF3U, HF3U



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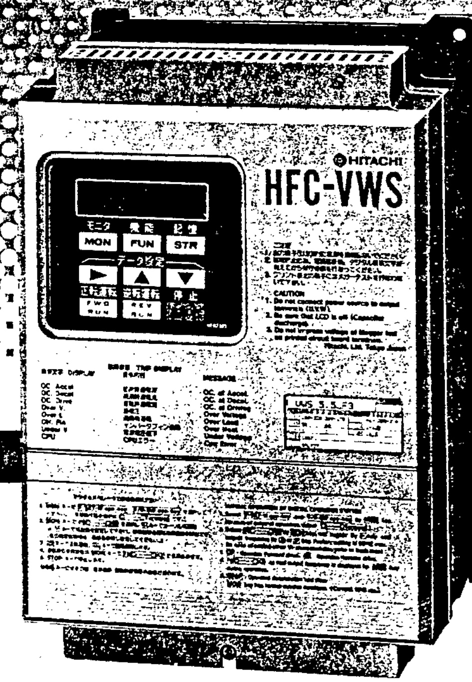
Occurrence and Lower Noise



HFC-VWS SERIES

▼ THREE PHASE, 200 V CLASS

MODEL NAME	1.5LD3	2.5LD3	3.5LD3
*APPLICABLE MOTOR (4P, kW)	0.75	1.5	2.2

MODEL NAME	5.5LF3	8LF3	11LF3	16LF3	22LF3	33LF3	40LF3	50LF3	60LF3	75LF3
*APPLICABLE MOTOR (4P, kW)	3.7	5.5	7.5	11	15	18.5, 22	30	37	45	55

▼ THREE PHASE, 400 V CLASS

MODEL NAME	2.5HF3	3.5HF3	5.5HF3	8HF3	11HF3	16HF3	22HF3	33HF3	40HF3	50HF3
*APPLICABLE MOTOR (4P, kW)	1.5	2.2	3.7	5.5	7.5	11	15	18.5, 22	30	37

MODEL NAME	60HF3	75HF3	100HF3	120HF3	150HF3	180HF3
*APPLICABLE MOTOR (4P, kW)	45	55	75	90	110	150

*Applicable motors are indicated according to the characteristics of Hitachi standard three phase 4 pole motors.

(Description of Type Symbol)

HFC-VWS 5.5HF3UH

- HFC: Hitachi inverter
- Ground fault protection
  - H: factory ground fault equipped
  - None: (less factory ground fault)
- U.S.A. version
- Version number
- Digital display panel
- Input voltage
  - L: three phase, 200 V class
  - H: three phase, 400 V class
- Output capacity (kVA)
- Function and application (S: standard type)
- Output waveform (W: PWM control system)
- Control system (V: voltage source type)

Rec'd 1/10/92
ANDERSON

TECO AMERICAN INC.

EFFECTIVE 4-1-90
(SUPERSEDES: NEW)

Contractor .6
User .8

HFC-VWS-3 INVERTER LIST PRICES

200v Class

CATALOG NUMBER HFC-VWS-	Output 230V kVA	Output 230V rms amps	Typical motor hp	DIMENSIONS-INCHES (cm) Height	Width	Depth	Approx Wt. Lb (kg)	LIST PRICE
1.5 LD 3 UH	2.0	5	1	11.8 (30)	8.7 (22)	5.5 (14)	10 (4.5)	$ 888.00
2.5 LD 3 UH	3.0	7.5	2	11.8 (30)	8.7 (22)	6.9 (17.5)	11.5 (5.2)	1,000.00
3.5 LD 3 UH	4.1	10.5	3	11.8 (30)	8.7 (22)	6.9 (17.5)	13 (6.0)	1,111.00
5.5 LF 3 UH	6.5	16.5	5	11.8 (30)	8.7 (22)	6.9 (17.5)	14 (6.5)	1,333.00
8 LF 3 UH	9.5	24	7.5	17.3 (44)	9.8 (25)	7.7 (19.5)	26.5 (12.0)	2,000.00
11 LF 3 UH	12	32	10	17.3 (44)	9.8 (25)	7.7 (19.5)	30 (13.5)	2,666.00
16 LF 3 UH	18	46	15	17.3 (44)	9.8 (25)	7.7 (19.5)	31 (14.0)	3,555.00
22 LF 3 UH	25	64	20	17.7 (45)	12.8 (32.5)	9.5 (24)	48.5 (22.0)	4,444.00
33 LF 3 U	37	95	30	19.7 (50)	15.4 (39)	10.6 (27)	57 (26.0)	5,888.00
40 LF 3 U	48	121	40	24.4 (62)	15.4 (39)	10.6 (27)	66 (30.0)	8,111.00
50 LF 3 U	57	145	50	24.4 (62)	15.4 (39)	10.6 (27)	88 (40.0)	9,555.00
60 LF 3 U	72	182	60	31.5 (80)	18.9 (48)	10.6 (27)	128 (58.0)	11,111.00
75 LF 3 U	87	220	75	31.5 (80)	18.9 (48)	10.6 (27)	128 (58.0)	12,444.00

400v Class

CATALOG NUMBER HFC-VWS-	Output 460V kVA	Output 460V rms amps	Typical motor hp	DIMENSIONS-INCHES (cm) Height	Width	Depth	Approx Wt. Lb (kg)	LIST PRICE
2.5 HF 3 UH	3.0	3.8	2	11.8 (30)	8.7 (22)	6.9 (17.5)	16.5 (7.5)	$1,333.00
3.5 HF 3 UH	4.2	5.3	3	11.8 (30)	8.7 (22)	6.9 (17.5)	16.5 (7.5)	1,555.00
5.5 HF 3 UH	6.8	8.6	5	11.8 (30)	8.7 (22)	6.9 (17.5)	19 (8.5)	1,833.00
8 HF 3 UH	10	13	7.5	17.3 (44)	9.8 (25)	7.7 (19.5)	32 (14.5)	2,611.00
11 HF 3 UH	12	16	10	17.3 (44)	9.8 (25)	7.7 (19.5)	33 (15)	3,277.00
16 HF 3 UH	18	23	15	17.7 (45)	12.8 (32.5)	9.5 (24)	50 (22.5)	4,333.00
22 HF 3 UH	25	32	20	17.7 (45)	12.8 (32.5)	9.5 (24)	54 (24.5)	5,055.00
33 HF 3 U	38	48	30	19.7 (50)	15.4 (39)	10.6 (27)	66 (30)	7,388.00
40 HF 3 U	46	58	40	24.4 (62)	15.4 (39)	10.6 (27)	88 (40)	8,777.00
50 HF 3 U	59	75	50	27.6 (70)	18.9 (48)	10.6 (27)	106 (48)	10,555.00
60 HF 3 U	71	90	60	27.6 (70)	18.9 (48)	10.6 (27)	124 (56)	12,000.00
75 HF 3 U	87	110	75	27.6 (70)	18.9 (48)	10.6 (27)	128 (58)	13,333.00
100 HF 3 U	118	149	100	41.7 (106)	21.7 (55)	11.8 (30)	232 (105)	17,555.00
120 HF 3 U	140	176	125	41.7 (106)	21.7 (55)	11.8 (30)	232 (105)	19,333.00
150 HF 3 U	172	217	150	51.2 (130)	21.7 (55)	11.8 (30)	331 (150)	21,555.00
180 HF 3 U	207	260	200	51.2 (130)	21.7 (55)	11.8 (30)	353 (160)	27,444.00

6877 WYNNWOOD, HOUSTON, TEXAS 1-800-USE-TECO

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**                  T R A C E   6 0 0   A N A L Y S I S                       **
**                                                                            **
**                  by              **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO (DD-VAV)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 9:11: 6 3/16/92
Dataset Name: 300A .TM

AIRFLOW - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

SYSTEM SUMMARY
(Design Airflow Quantities)

System Number	System Type	Main Outside Airflow (Cfm)	Main Cooling Airflow (Cfm)	Main Heating Airflow (Cfm)	Main Return Airflow (Cfm)	Main Exhaust Airflow (Cfm)	Auxil. Supply Airflow (Cfm)	Room Exhaust Airflow (Cfm)
1	DDVAV	907	12,959	4,501	13,282	1,230	0	0
2	DDVAV	1,522	21,569	4,502	21,893	1,845	0	0
3	DDVAV	3,209	45,229	10,696	46,216	4,196	0	0
Totals		5,639	79,757	19,699	81,390	7,272	0	0

CAPACITY - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

SYSTEM SUMMARY
(Design Capacity Quantities)

System Number	System Type	Cooling: Main Sys. Capacity (Tons)	Cooling: Aux. Sys. Capacity (Tons)	Cooling: Opt. Vent Capacity (Tons)	Cooling Totals (Tons)	Heating: Main Sys. Capacity (Btuh)	Heating: Aux. Sys. Capacity (Btuh)	Heating: Preheat Capacity (Btuh)	Heating: Reheat Capacity (Btuh)	Heating: Humidif. Capacity (Btuh)	Heating: Opt. Vent Capacity (Btuh)	Heating Totals (Btuh)
1	DDVAV	26.4	0.0	0.0	26.4	-340,590	0	-25,286	0	0	0	-365,876
2	DDVAV	42.9	0.0	0.0	42.9	-420,206	0	-41,696	0	0	0	-461,902
3	DDVAV	93.1	0.0	0.0	93.1	-1,219,000	0	-86,523	0	0	0	-1,305,523
Totals		162.4	0.0	0.0	162.4	-1,979,796	0	-153,504	0	0	0	-2,133,300

The building peaked at hour 16 month 7 with a capacity of 162.4 tons

ENGINEERING CHECKS - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

ENGINEERING CHECKS

System Number	Main/ Auxiliary	System Type	Percent Outside Air	Cooling Cfm/ Sq Ft	Cooling Cfm/ Ton	Cooling Sq Ft /Ton	Cooling Btuh/ Sq Ft	Heating Cfm/ Sq Ft	Heating Btuh/ Sq Ft	Floor Area Sq Ft
1	Main	DDVAV	7.00	1.07	490.0	456.2	26.31	0.37	-30.32	12,065
2	Main	DDVAV	7.06	1.79	502.7	281.2	42.67	0.37	-38.28	12,065
3	Main	DDVAV	7.09	1.23	486.0	394.5	30.42	0.29	-35.56	36,710

System 1 Block DDVAV - DOUBLE DUCT VAV

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1

Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	11,482		11,482	3.62	0	0.00	0	-11,284	5.36
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	73,720	23,679		97,399	30.69	73,720	30.53	-128,997	-166,870	79.20
Partition	-24,826			-24,826	-7.82	-24,826	-10.28	-60,134	-60,134	28.54
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	5,260			5,260	1.66	6,869	2.84	-14,848	-14,848	7.05
Sub Total==>	54,154	35,161		89,316	28.14	55,763	23.09	-203,980	-253,137	120.15
Internal Loads										
Lights	60,341	0		60,341	19.01	60,341	24.99	0	0	0.00
People	27,300			27,300	8.60	14,950	6.19	0	0	0.00
Misc	103,877	0	0	103,877	32.73	103,877	43.02	0	0	0.00
Sub Total==>	191,518	0	0	191,518	60.34	179,168	74.20	0	0	0.00
Ceiling Load	8,104	-8,104		0	0.00	6,525	2.70	-24,436	0	0.00
Outside Air	0	0	0	15,324	4.83	0	0.00	0	0	0.00
Sup. Fan Heat				23,638	7.45		0.00		8,348	-3.96
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		-2,420	0	-2,420	-0.76		0.00		34,103	-16.19
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	253,776	24,638	0	317,376	100.00	241,456	100.00	-228,416	-210,686	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	26.4	317.4	311.2	13,036	78.6	59.3	56.7	53.1	49.8	56.7
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	26.4	317.4								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-340.6	4,603	47.7	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-25.3	907	24.0	53.1
Reheat	-0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-365.9			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	907	0
Infil	323	323
Supply	12,959	4,501
Mincfm	0	0
Return	13,036	4,603
Exhaust	907	4,603
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	1.07
Clg Cfm/Ton	489.98
Clg Sqft/Ton	456.19
Clg Btuh/Sqft	26.31
No. People	65
Htg % OA	0.0
Htg Cfm/SqFt	0.37
Htg Btuh/SqFt	-30.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	125.0
Plenum	77.2	64.2
Return	77.2	64.3
Ret/OA	78.6	24.0
Runarnd	74.5	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

System 2 Block DDVAV - DOUBLE DUCT VAV

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					*	Mo/Hr: 7/16		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					*	OADB: 97		*	OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	11,727		11,727	2.28	*	0	0.00	*	0	-11,282	5.40
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	65,647	21,666		87,313	16.96	*	65,647	16.46	*	-124,832	-161,268	77.22
Partition	-27,053			-27,053	-5.25	*	-27,053	-6.78	*	-64,928	-64,928	31.09
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	6,209			6,209	1.21	*	6,869	1.72	*	-14,848	-14,848	7.11
Sub Total==>	44,802	33,393		78,196	15.19	*	45,463	11.40	*	-204,608	-252,326	120.82
Internal Loads						*			*			
Lights	73,523	0		73,523	14.28	*	73,523	18.43	*	0	0	0.00
People	19,740			19,740	3.83	*	10,810	2.71	*	0	0	0.00
Misc	266,323	0	0	266,323	51.73	*	266,323	66.77	*	0	0	0.00
Sub Total==>	359,585	0	0	359,585	69.84	*	350,655	87.91	*	0	0	0.00
Ceiling Load	4,807	-4,807		0	0.00	*	2,755	0.69	*	-23,857	0	0.00
Outside Air	0	0	0	30,394	5.90	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				49,684	9.65	*		0.00	*		10,552	-5.05
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		-3,016	0	-3,016	-0.59	*		0.00	*		32,924	-15.76
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
Grand Total==>	409,195	25,570	0	514,843	100.00	*	398,874	100.00	*	-228,465	-208,850	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	42.9	514.8	509.7	21,664	77.9	58.0	52.2	52.6	48.6	52.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	42.9	514.8								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

-----------HEATING COIL SELECTION-----------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	4,601	29.6	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-41.7	1,522	24.0	52.6
Reheat	-0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-461.9			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	1,522	0
Infil	323	323
Supply	21,569	4,502
Mincfm	0	0
Return	21,664	4,601
Exhaust	1,522	4,601
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.1
Clg Cfm/Sqft	1.79
Clg Cfm/Ton	502.74
Clg Sqft/Ton	281.21
Clg Btuh/Sqft	42.67
No. People	47
Htg % OA	0.0
Htg Cfm/SqFt	0.37
Htg Btuh/SqFt	-38.28

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	125.0
Plenum	76.4	64.4
Return	76.4	64.5
Ret/OA	77.9	24.0
Runarnd	74.3	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DDVAV - DOUBLE DUCT VAV

************************* COOLING COIL PEAK						************** CLG SPACE PEAK		************ HEATING COIL PEAK ********		
Peaked at Time ==>		Mo/Hr: 7/16				Mo/Hr: 7/16			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				OADB: 97			OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	37,742		37,742	3.38	0	0.00	0	-36,526	7.22
Glass Solar	14,028	0		14,028	1.26	14,028	1.67	0	0	0.00
Glass Cond	6,931	0		6,931	0.62	6,931	0.82	-16,967	-16,967	3.35
Wall Cond	131,183	45,679		176,862	15.84	131,183	15.57	-266,695	-349,375	69.05
Partition	-45,200			-45,200	-4.05	-45,200	-5.37	-149,871	-149,871	29.62
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	18,514			18,514	1.66	21,270	2.52	-45,361	-45,361	8.96
Sub Total==>	125,455	83,421		208,876	18.70	128,211	15.22	-478,895	-598,101	118.20
Internal Loads										
Lights	238,645	0		238,645	21.37	238,645	28.33	0	0	0.00
People	64,680			64,680	5.79	35,420	4.20	0	0	0.00
Misc	425,318	0	0	425,318	38.09	425,318	50.49	3,208	3,208	-0.63
Sub Total==>	728,643	0	0	728,643	65.25	699,382	83.02	3,208	3,208	-0.63
Ceiling Load	15,288	-15,288		0	0.00	14,811	1.76	-67,112	0	0.00
Outside Air	0	0	0	61,242	5.48	0	0.00	0	0	0.00
Sup. Fan Heat				123,046	11.02		0.00		29,139	-5.76
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		-5,055	0	-5,055	-0.45		0.00		59,751	-11.81
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	869,386	63,078	0	1,116,751	100.00	842,405	100.00	-542,798	-506,002	100.00

------COOLING COIL SELECTION------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	93.1	1,116.8	1,099.2	45,238	77.6	58.2	53.3	52.2	48.4	52.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	93.1	1,116.8								

------AREAS------

	Gross Total	Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

------HEATING COIL SELECTION------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	10,713	6.2	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-86.5	3,209	24.0	52.2
Reheat	-0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,305.5			

------AIRFLOWS (cfm)------

Type	Cooling	Heating
Vent	3,209	0
Infil	987	987
Supply	45,229	10,696
Mincfm	0	0
Return	45,238	10,713
Exhaust	3,209	10,713
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.1
Clg Cfm/Sqft	1.23
Clg Cfm/Ton	486.00
Clg Sqft/Ton	394.47
Clg Btuh/Sqft	30.42
No. People	154
Htg % OA	0.0
Htg Cfm/SqFt	0.29
Htg Btuh/SqFt	-35.56

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	125.0
Plenum	76.1	66.2
Return	76.1	66.2
Ret/OA	77.6	24.0
Runarnd	74.5	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

--------------------------------- B U I L D I N G   U - V A L U E S ---------------------------------

		Room U-Values (Btu/hr/sqft/F)									Room	Room
Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Mass (lb/ sqft)	Capac. (Btu/ sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	40 79.96	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

--- B U I L D I N G   A R E A S ---

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ZMT EAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0	0	0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	8.1	7	628	-106,665	35	1,740	3,987.9	0	0	0.0	0	0
5 - 10	16.2	8	704	-213,330	27	1,340	7,975.7	0	0	0.0	0	0
10 - 15	24.4	9	826	-319,995	16	785	11,963.6	0	0	0.0	0	0
15 - 20	32.5	10	870	-426,660	9	447	15,951.5	0	0	0.0	0	0
20 - 25	40.6	7	636	-533,325	6	305	19,939.3	0	0	0.0	0	0
25 - 30	48.7	9	796	-639,990	4	189	23,927.2	3	258	0.0	0	0
30 - 35	56.8	7	597	-746,655	2	120	27,915.0	16	1,376	0.0	0	0
35 - 40	65.0	6	514	-853,320	1	41	31,902.9	17	1,512	0.0	0	0
40 - 45	73.1	7	655	-959,985	0	0	35,890.8	16	1,375	0.0	0	0
45 - 50	81.2	5	434	-1,066,650	0	0	39,878.6	13	1,140	0.0	0	0
50 - 55	89.3	4	373	-1,173,315	0	0	43,866.5	12	1,086	0.0	0	0
55 - 60	97.4	4	351	-1,279,980	0	0	47,854.4	8	692	0.0	0	0
60 - 65	105.6	4	379	-1,386,645	0	0	51,842.2	2	217	0.0	0	0
65 - 70	113.7	2	210	-1,493,311	0	0	55,830.1	3	236	0.0	0	0
70 - 75	121.8	2	136	-1,599,975	0	0	59,818.0	3	227	0.0	0	0
75 - 80	129.9	1	122	-1,706,641	0	0	63,805.8	2	189	0.0	0	0
80 - 85	138.1	2	147	-1,813,305	0	0	67,793.7	2	193	0.0	0	0
85 - 90	146.2	1	62	-1,919,971	0	0	71,781.5	1	131	0.0	0	0
90 - 95	154.3	1	123	-2,026,636	0	0	75,769.4	1	85	0.0	0	0
95 - 100	162.4	2	197	-2,133,301	0	0	79,757.3	0	43	0.0	0	0
Hours Off	0.0	0	0	0	0	3,793	0.0	0	0	0.0	0	8,760

$\frac{\text{TON-HRS}}{\text{YR}} = 644,400$

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	244,173	553	4,414	51	12
Feb	224,503	558	3,512	52	11
March	268,288	598	1,615	99	6
April	275,932	653	471	137	3
May	318,064	688	96	205	2
June	326,038	722	0	250	0
July	345,612	736	0	304	0
Aug	349,221	731	0	300	0
Sept	317,545	700	34	230	1
Oct	295,923	649	544	152	2
Nov	255,015	594	1,785	92	6
Dec	251,938	564	3,379	66	8
Total	3,472,254	736	15,849	1,938	12

Building Energy Consumption = 220,836 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 221,641 (Btu/Sq Ft/Year)

Σ monthly kW = ~~8492~~ 7,746

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S ------------------------------------

Utility ELECTRIC DEMAND

Peak Value 735.8 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1001S	2-STG CTV <555 TONS	195.9	26.62
Sub Total			195.9	26.62
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	46.3	6.29
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.3	4.52
3		SUMMATION OF FAN ELECTRICAL DEMAND	115.0	15.63
Sub Total			194.6	26.45
Sub Total			0.0	0.00
Miscellaneous				
Lights			109.1	14.83
Base Utilities			0.0	0.00
Misc Equipment			236.2	32.10
Sub Total			345.3	46.93
Grand Total			735.8	100.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 300 - CONSOLIDATED CHILLER PLANT			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/10/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$56,100	
B. SIOH COST	(5.5% of 1A) =		$3,086	
C. DESIGN COST	(6.0% of 1A) =		$3,366	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$62,552	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		---------->	$62,552

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	635	$4,112	15.23	$62,621	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		635	4,111.7		---------->	$62,621

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS + MAINTENANCE COST SAVINGS) = $8,009

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $117,572

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $117,572

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $20,665

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 1.33

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$12,121
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$180,193
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.88
7	SIMPLE PAYBACK (SPB)	(1F/4) =	5.16

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

PROPOSED TOTAL CONTRACT PRICE:

CONTRACT FOR (Work to be performed): CONSOLIDATED CHILLER PLANT – BLDG 300

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

PURCHASE REQUEST NUMBER:

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	CONSOLIDATED CHILLER PLANT									
	100 TON WTR CLD RECIP. CHILLER	EA	1	51000	51000	Cost includes Material & Labor w/ Overhead & Profit				$51,000
	CONTINGENCY (10%)									$5,100
	Source: Means Mechanical Cost Data, 1992									
	TOTAL THIS SHEET									$56,100

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**                                                                         **
**              T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                         **
**              by            **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO ✓ Consolidated Chilled Water Plant

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 5:50 3/13/92
Dataset Name: 300 .TM

System 1 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************* HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1

Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	12,734		12,734	2.70	0	0.00	0	-13,550	3.56
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	81,136	27,781		108,917	23.06	81,117	28.85	-128,969	-173,237	45.46
Partition	-4,965			-4,965	-1.05	-4,965	-1.77	-60,134	-60,134	15.78
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	6,185			6,185	1.31	7,886	2.80	-14,848	-14,848	3.90
Sub Total==>	82,355	40,515		122,871	26.01	84,038	29.88	-203,952	-261,770	68.69
Internal Loads										
Lights	60,341	0		60,341	12.77	60,341	21.46	0	0	0.00
People	27,300			27,300	5.78	14,950	5.32	0	0	0.00
Misc	103,877	0	0	103,877	21.99	103,877	36.94	0	0	0.00
Sub Total==>	191,518	0	0	191,518	40.54	179,168	63.71	0	0	0.00
Ceiling Load	3,991	-3,991		0	0.00	3,230	1.15	-4,628	0	0.00
Outside Air	0	0	0	62,240	13.18	0	0.00	0	-149,417	39.21
Sup. Fan Heat				84,211	17.83		0.00		84,211	-22.10
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	14,770			14,770	3.13	14,770	5.25	-58,220	-58,220	15.28
Exhaust Heat		-3,250	0	-3,250	-0.69		0.00		4,116	-1.08
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	292,634	33,274	0	472,359	100.00	281,206	100.00	-266,799	-381,080	100.00

------------------COOLING COIL SELECTION------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	39.4	472.4	478.2	46,440	74.7	58.0	56.8	63.8	54.1	57.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	39.4	472.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

-----------HEATING COIL SELECTION-----------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-340.6	46,440	70.3	78.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	46,440	67.4	63.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-340.6			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	3,251	3,251
Infil	323	323
Supply	46,440	46,440
Mincfm	0	0
Return	46,440	46,440
Exhaust	3,251	3,251
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.85
Clg Cfm/Ton	1179.78
Clg Sqft/Ton	306.51
Clg Btuh/Sqft	39.15
No. People	65
Htg % OA	7.0
Htg Cfm/SqFt	3.85
Htg Btuh/SqFt	-28.23

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.7	78.0
Plenum	73.0	70.5
Return	73.0	70.7
Ret/OA	74.7	67.4
Runarnd	72.0	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 2 Block DD - DOUBLE DUCT

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	12,709		12,709	2.03	*	0	0.00	*	0	-13,608	4.14
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	72,716	24,577		97,293	15.58	*	72,716	16.75	*	-124,832	-167,314	50.84
Partition	-5,411			-5,411	-0.87	*	-5,411	-1.25	*	-64,928	-64,928	19.73
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	7,121			7,121	1.14	*	7,885	1.82	*	-14,848	-14,848	4.51
Sub Total==>	74,427	37,286		111,713	17.89	*	75,191	17.32	*	-204,608	-260,698	79.22
Internal Loads						*			*			
Lights	73,523	0		73,523	11.77	*	73,523	16.93	*	0	0	0.00
People	19,740			19,740	3.16	*	10,810	2.49	*	0	0	0.00
Misc	266,323	0	0	266,323	42.64	*	266,323	61.34	*	0	0	0.00
Sub Total==>	359,585	0	0	359,585	57.57	*	350,655	80.76	*	0	0	0.00
Ceiling Load	4,319	-4,319		0	0.00	*	3,459	0.80	*	-5,209	0	0.00
Outside Air	0	0	0	60,882	9.75	*	0	0.00	*	0	-126,942	38.58
Sup. Fan Heat				90,495	14.49	*		0.00	*		90,495	-27.50
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	4,876			4,876	0.78	*	4,876	1.12	*	-35,774	-35,774	10.87
Exhaust Heat		-2,988	0	-2,988	-0.48	*		0.00	*		3,851	-1.17
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	443,207	29,979	0	624,563	100.00	*	434,181	100.00	*	-245,591	-329,069	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	52.0	624.6	622.4	39,460	74.8	57.0	52.4	58.1	50.8	52.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	52.0	624.6								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

-----------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	39,460	67.4	78.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	39,460	67.3	58.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-420.2			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,762	2,762
Infil	323	323
Supply	39,460	39,460
Mincfm	0	0
Return	39,460	39,460
Exhaust	2,762	2,762
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	3.27
Clg Cfm/Ton	758.16
Clg Sqft/Ton	231.81
Clg Btuh/Sqft	51.77
No. People	47
Htg % OA	7.0
Htg Cfm/SqFt	3.27
Htg Btuh/SqFt	-34.83

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	60.5	78.5
Plenum	73.1	70.4
Return	73.1	70.5
Ret/OA	74.8	67.3
Runarnd	72.0	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DD - DOUBLE DUCT

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	41,022		41,022	2.65	0	0.00	0	-43,963	5.50
Glass Solar	14,028	0		14,028	0.91	40,581	4.51	0	0	0.00
Glass Cond	8,239	0		8,239	0.53	5,819	0.65	-16,967	-16,967	2.12
Wall Cond	147,401	52,964		200,366	12.94	135,487	15.06	-266,726	-361,665	45.23
Partition	-12,991			-12,991	-0.84	-12,991	-1.44	-149,871	-149,871	18.74
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	20,007			20,007	1.29	23,124	2.57	-45,361	-45,361	5.67
Sub Total==>	176,683	93,986		270,670	17.48	192,019	21.34	-478,926	-617,828	77.27
Internal Loads										
Lights	238,645	0		238,645	15.41	238,645	26.52	0	0	0.00
People	64,680			64,680	4.18	35,420	3.94	0	0	0.00
Misc	425,318	0	0	425,318	27.47	425,318	47.27	3,208	3,208	-0.40
Sub Total==>	728,643	0	0	728,643	47.06	699,382	77.72	3,208	3,208	-0.40
Ceiling Load	7,657	-7,657		0	0.00	7,258	0.81	-11,689	0	0.00
Outside Air	0	0	0	189,859	12.26	0	0.00	0	-430,464	53.84
Sup. Fan Heat				363,958	23.51		0.00		363,958	-45.52
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	1,182			1,182	0.08	1,182	0.13	-127,578	-127,578	15.96
Exhaust Heat		-5,903	0	-5,903	-0.38		0.00		9,137	-1.14
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	914,165	80,427	0	1,548,408	100.00	899,842	100.00	-614,985	-799,567	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	129.0	1,548.4	1,560.1	133,808	74.4	57.5	55.1	62.1	53.0	55.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	129.0	1,548.4								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	133,808	67.3	76.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	133,808	67.7	62.1
Reheat	0.0	0	0.0	0.0
Humidif	-439.3	10,353	4.7	75.1
Opt Vent	0.0	0	0.0	0.0
Total	-1,658.3			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	9,366	9,366
Infil	987	987
Supply	133,808	133,808
Mincfm	0	0
Return	133,808	133,808
Exhaust	9,366	9,366
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	7.0
Clg Cfm/Sqft	3.64
Clg Cfm/Ton	1037.00
Clg Sqft/Ton	284.50
Clg Btuh/Sqft	42.18
No. People	154
Htg % OA	7.0
Htg Cfm/SqFt	3.64
Htg Btuh/SqFt	-33.21

TEMPERATURES (F)

Type	Clg	Htg
SADB	65.0	76.8
Plenum	72.7	70.9
Return	72.7	71.0
Ret/OA	74.4	67.7
Runarnd	72.0	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3 96	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 300

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	Z1-BSAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0		0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 300

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	0
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725,737	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	0
35 - 40	88.2	9	801	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	0	0.0	0	8,760

P300

CONSOLIDATED CHW PLANT

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	356,352	648	6,458	140	14
Feb	322,568	648	5,227	130	14
March	365,567	670	2,512	178	8
April	360,455	704	585	224	3
May	391,852	720	9	321	0
June	396,768	742	0	381	0
July	413,814	751	0	416	0
Aug	415,790	746	0	404	0
Sept	381,326	723	0	318	0
Oct	378,301	705	782	246	4
Nov	350,087	668	2,815	171	9
Dec	356,842	653	5,163	151	11
Total	4,489,721	751	23,551	3,080	14

Building Energy Consumption = 290,571 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 291,768 (Btu/Sq Ft/Year)

$\sum$ monthly kW = ~~[illegible]~~ 8,378

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 751.4 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	90.0	11.98
2	EQ1001S	2-STG CTV <555 TONS	114.6	15.26
Sub Total			204.6	27.24
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	6.45
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.47
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	15.89
Sub Total			201.4	26.81
Sub Total			0.0	0.00
Miscellaneous				
Lights			109.1	14.53
Base Utilities			0.0	0.00
Misc Equipment			236.2	31.43
Sub Total			345.3	45.96
Grand Total			751.4	100.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 300 – MODIFIED CONFIGURATION			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	10/22/92	ECONOMIC LIFE:	15	PREPARED BY:	T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST	=	$446,296		
B. SIOH COST	(5.5% of 1A) =	$24,546		
C. DESIGN COST	(6.0% of 1A) =	$26,778		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$497,620		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	---------->	$497,620	

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	4,745	$30,723	10.79	$331,501	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	743	$1,644	12.38	$20,353	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		5,488	32,367.0		---------->	$351,854

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELECT. DEMAND SAVINGS AND MAINTENANCE COST SAVINGS) = $71,413

1 DISCOUNT FACTOR (From Table A–2) = 10.67

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $761,979

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. Utility rebate	$54,788		0.96	$52,596
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$54,788			$52,596

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $814,576

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $116,112

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.94

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/15)) =	$105,972
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,166,430
6 DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.34
7 SIMPLE PAYBACK (SPB)	(1F/4) =	4.70

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	
CONTRACT FOR (Work to be performed) BLDG 300 ECIP PACKAGE – CONSOLIDATED CHILLER PLANT, VAV, LIGHTING AND THERMAL STORAGE		PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	CONSOLIDATED CHILLER PLANT	EA	1		56100.0	Cost includes	Material & Labor w/ Overhead	& Profit		$56,100.0
	DUAL-DUCT VARIABLE-AIR-VOLUME ON AHU	EA	1		177384.0			35228.0		$268,913.0
	LOW WATTAGE LAMPS AND BALLASTS	EA	1	LS	15369.9			23413.1		$38,783.0
	1000 TON-HR THERMAL STORAGE	EA	1	LS						$82,500.0
	TOTAL THIS SHEET				248853.9			58641.1		$446,296.0

D14-2

Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Mat. costs include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 300 – MODIFIED CONFIGURATION WO/THERMAL STORAGE FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 10/22/92 ECONOMIC LIFE: 15 PREPARED BY: T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST	=	$82,500	
B. SIOH COST	(5.5% of 1A) =	$4,538	
C. DESIGN COST	(6.0% of 1A) =	$4,950	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$91,988	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$91,988

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	(21)	($136)	10.79	($1,466)	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	0	$0	12.38	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		(21)	(135.8)		————>	($1,466)

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/–) (ELECT. DEMAND SAVINGS AND MAINTENANCE COST SAVINGS) = $25,019

1 DISCOUNT FACTOR (From Table A–2) = 10.67

2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $266,947

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. Utility rebate	$54,788		0.96	$52,596
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$54,788			$52,596

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $319,544

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = ($484)

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = -0.02

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$27,074
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$318,078
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	3.46
7 SIMPLE PAYBACK (SPB)	(1F/4) =	3.40

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 300 - MOD. CONFIG. W/O VARIABLE AIR VOLUME SYSTEMS ON AHUs FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 10/22/92 ECONOMIC LIFE: 15 PREPARED BY: T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST	=	$268,913	
B. SIOH COST	(5.5% of 1A) =	$14,790	
C. DESIGN COST	(6.0% of 1A) =	$16,135	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$299,838	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D - 1E) =	---------->	$299,838

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	3,940	$25,514	10.79	$275,300	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	761	$1,684	12.38	$20,843	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		4,701	27,198.0		---------->	$296,143

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = $17,336
1 DISCOUNT FACTOR (From Table A-2) = 10.67
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $184,970

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $184,970

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $97,727
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 1.31
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$44,533
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$481,113
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	1.60
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	6.73

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 300 – MODIFIED CONFIG. W/O ENERGY EFFICIENT LIGHTING			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	10/22/92	ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST		=	$38,783	
B. SIOH COST		(5.5% of 1A) =	$2,133	
C. DESIGN COST		(6.0% of 1A) =	$2,327	
D. ENERGY CREDIT		(1A + 1B + 1C) =	$43,243	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT		(1D – 1E) =	------------>	$43,243

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	77	$498	15.23	$7,592	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	(28)	($61)	19.64	($1,195)	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		49	437.6		------------>	$6,396

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$5,655	
1 DISCOUNT FACTOR	(From Table A–2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$83,015	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$83,015
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$2,111	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.20	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$6,093
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$89,412
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.07
7 SIMPLE PAYBACK (SPB)	(1F/4) =	7.10

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 300 – MOD. CONFIG. W/O CONSOLIDATED CHILLER PLANT			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	10/22/92	ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST	=		$56,100	
B. SIOH COST	(5.5% of 1A) =		$3,086	
C. DESIGN COST	(6.0% of 1A) =		$3,366	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$62,552	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		——————>	$62,552

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	617	$3,995	15.23	$60,839	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		617	3,994.7		——————>	$60,839

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS + MAINTENANCE COST SAVINGS)	=		$3,212	
1 DISCOUNT FACTOR	(From Table A–2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$47,152	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$47,152
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$20,077	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	1.29	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$7,207
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$107,991
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.73
7 SIMPLE PAYBACK (SPB)	(1F/4) =	8.68

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**                                                                            **
**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by           **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG P300: MODIFIED CONFIGURATION

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:31:55 10/19/92
Dataset Name: 300MF1 .TM

System 1 Block DDVAV - DOUBLE DUCT VAV

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	10,080		10,080	3.71	*	0	0.00	*	0	-9,111	4.87
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	73,720	19,023		92,743	34.16	*	73,720	32.03	*	-128,997	-161,011	86.09
Partition	-24,826			-24,826	-9.14	*	-24,826	-10.79	*	-60,134	-60,134	32.15
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	5,231			5,231	1.93	*	6,869	2.98	*	-14,848	-14,848	7.94
Sub Total==>	54,125	29,103		83,228	30.65	*	55,763	24.23	*	-203,980	-245,105	131.06
Internal Loads						*			*			
Lights	48,829	0		48,829	17.98	*	48,829	21.22	*	0	0	0.00
People	27,300			27,300	10.05	*	14,950	6.50	*	0	0	0.00
Misc	103,877	0	0	103,877	38.26	*	103,877	45.13	*	0	0	0.00
Sub Total==>	180,006	0	0	180,006	66.30	*	167,656	72.85	*	0	0	0.00
Ceiling Load	26,344	-26,344		0	0.00	*	6,734	2.93	*	-24,436	0	0.00
Outside Air	0	0	0	14,582	5.37	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		-6,297	0	-6,297	-2.32	*		0.00	*		58,089	-31.06
Terminal Bypass		0	0	0	-0.00	*		0.00	*		0	0.00
Grand Total==>	260,474	-3,537	0	271,519	100.00	*	230,153	100.00	*	-228,416	-187,016	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	22.6	271.5	265.2	13,418	83.0	60.7	56.9	53.1	52.1	66.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	22.6	271.5								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	17,254		
ExFlr	0		
Roof	4,235	0	0
Wall	8,132	0	0

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-340.6	4,942	53.0	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-24.1	866	24.0	53.1
Reheat	-0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-364.7			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	866	0
Infil	323	323
Supply	12,374	4,501
Mincfm	0	0
Return	13,418	4,942
Exhaust	866	4,942
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.0
Clg Cfm/Sqft	1.03
Clg Cfm/Ton	546.89
Clg Sqft/Ton	533.23
Clg Btuh/Sqft	22.50
No. People	65
Htg % OA	0.0
Htg Cfm/SqFt	0.37
Htg Btuh/SqFt	-30.23

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	125.0
Plenum	82.0	59.8
Return	82.0	59.7
Ret/OA	83.0	24.0
Runarnd	74.4	72.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.4	0.0

System 2 Block DDVAV - DOUBLE DUCT VAV

************************** COOLING COIL PEAK ********************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>		Mo/Hr: 7/16				Mo/Hr: 7/16			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				OADB: 97			OADB: 24	
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	10,261		10,261	2.35	0	0.00	0	-9,103	4.86
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	65,647	17,461		83,108	19.00	65,647	17.06	-124,832	-155,364	83.01
Partition	-27,053			-27,053	-6.18	-27,053	-7.03	-64,928	-64,928	34.69
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	6,189			6,189	1.41	6,869	1.78	-14,848	-14,848	7.93
Sub Total==>	44,783	27,722		72,505	16.57	45,463	11.81	-204,608	-244,242	130.49
Internal Loads										
Lights	59,476	0		59,476	13.60	59,476	15.45	0	0	0.00
People	19,740			19,740	4.51	10,810	2.81	0	0	0.00
Misc	266,323	0	0	266,323	60.88	266,323	69.19	0	0	0.00
Sub Total==>	345,538	0	0	345,538	78.99	336,608	87.45	0	0	0.00
Ceiling Load	23,737	-23,737		0	0.00	2,838	0.74	-23,857	0	0.00
Outside Air	0	0	0	29,330	6.70	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		-9,930	0	-9,930	-2.27		0.00		57,073	-30.49
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	414,058	-5,944	0	437,444	100.00	384,909	100.00	-228,465	-187,169	100.00

----------COOLING COIL SELECTION----------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	36.5	437.4	432.3	21,939	82.4	59.6	52.3	52.6	51.6	64.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	36.5	437.4								

----------AREAS----------

	Gross Total	Glass (sf)	(%)
Floor	12,065		
Part	15,624		
ExFlr	0		
Roof	4,235	0	0
Wall	7,884	0	0

----------HEATING COIL SELECTION----------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-420.2	4,941	36.2	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-40.3	1,472	24.0	52.6
Reheat	-0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-460.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	1,472	0
Infil	323	323
Supply	20,843	4,502
Mincfm	0	0
Return	21,939	4,941
Exhaust	1,472	4,941
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	7.1
Clg Cfm/Sqft	1.73
Clg Cfm/Ton	571.78
Clg Sqft/Ton	330.97
Clg Btuh/Sqft	36.26
No. People	47
Htg % OA	0.0
Htg Cfm/SqFt	0.37
Htg Btuh/SqFt	-38.17

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	55.0	125.0
Plenum	81.3	59.9
Return	81.3	59.9
Ret/OA	82.4	24.0
Runarnd	74.3	72.0
Fn MtrTD	0.8	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.8	0.0

System 3 Block DDVAV - DOUBLE DUCT VAV

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	34,240		34,240	3.71	0	0.00	0	-31,122	6.55
Glass Solar	14,028	0		14,028	1.52	14,028	1.76	0	0	0.00
Glass Cond	6,931	0		6,931	0.75	6,931	0.87	-16,967	-16,967	3.57
Wall Cond	131,183	38,155		169,338	18.35	131,183	16.45	-266,695	-339,542	71.42
Partition	-45,200			-45,200	-4.90	-45,200	-5.67	-149,871	-149,871	31.52
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	18,394			18,394	1.99	21,270	2.67	-45,361	-45,361	9.54
Sub Total==>	125,335	72,396		197,731	21.42	128,211	16.07	-478,895	-582,864	122.60
Internal Loads										
Lights	193,225	0		193,225	20.93	193,225	24.23	0	0	0.00
People	64,680			64,680	7.01	35,420	4.44	0	0	0.00
Misc	425,318	0	0	425,318	46.08	425,318	53.32	3,208	3,208	-0.67
Sub Total==>	683,223	0	0	683,223	74.02	653,963	81.99	3,208	3,208	-0.67
Ceiling Load	58,449	-58,449		0	0.00	15,433	1.93	-67,112	0	0.00
Outside Air	0	0	0	57,720	6.25	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		-15,643	0	-15,643	-1.69		0.00		104,240	-21.93
Terminal Bypass		0	0	0	-0.00		0.00		0	0.00
Grand Total==>	867,007	-1,696	0	923,030	100.00	797,607	100.00	-542,798	-475,416	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB Deg F	Entering WB Deg F	Entering HR Grains	Leaving DB Deg F	Leaving WB Deg F	Leaving HR Grains
Main Clg	76.9	923.0	905.5	45,144	81.0	59.4	53.5	52.2	51.1	63.4
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	76.9	923.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	36,710		
Part	41,631		
ExFlr	0		
Roof	13,521	0	0
Wall	17,879	501	3

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,219.0	11,502	14.3	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-82.0	3,041	24.0	52.2
Reheat	-0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,301.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	3,041	0
Infil	987	987
Supply	42,859	10,696
Mincfm	0	0
Return	45,144	11,502
Exhaust	3,041	11,502
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	7.1
Clg Cfm/Sqft	1.17
Clg Cfm/Ton	557.20
Clg Sqft/Ton	477.26
Clg Btuh/Sqft	25.14
No. People	154
Htg % OA	0.0
Htg Cfm/SqFt	0.29
Htg Btuh/SqFt	-35.44

TEMPERATURES (F)

Type	Clg	Htg
SADB	55.0	125.0
Plenum	79.8	62.7
Return	79.8	62.5
Ret/OA	81.0	24.0
Runarnd	74.4	72.0
Fn MtrTD	0.9	0.0
Fn BldTD	0.7	0.0
Fn Frict	2.1	0.0

BUILDING U-VALUES - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building		0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	Z1-BSMT EAST	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0	0	0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

‡

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	6.8	6	482	-106,312	34	1,682	3,803.8	0	0	0.0	0	0
5 - 10	13.6	6	490	-212,625	26	1,286	7,607.7	0	0	0.0	0	0
10 - 15	20.4	10	836	-318,937	17	825	11,411.5	0	0	0.0	0	0
15 - 20	27.2	7	580	-425,249	10	487	15,215.4	0	0	0.0	0	0
20 - 25	34.0	10	854	-531,561	7	355	19,019.2	0	0	0.0	0	0
25 - 30	40.8	6	486	-637,874	4	175	22,823.1	1	118	0.0	0	0
30 - 35	47.6	8	673	-744,186	3	147	26,626.9	10	887	0.0	0	0
35 - 40	54.4	7	585	-850,498	0	10	30,430.8	19	1,697	0.0	0	0
40 - 45	61.2	5	413	-956,811	0	0	34,234.6	14	1,207	0.0	0	0
45 - 50	68.0	6	521	-1,063,123	0	0	38,038.5	15	1,288	0.0	0	0
50 - 55	74.8	6	506	-1,169,435	0	0	41,842.3	12	1,093	0.0	0	0
55 - 60	81.6	4	349	-1,275,748	0	0	45,646.2	9	801	0.0	0	0
60 - 65	88.4	4	330	-1,382,060	0	0	49,450.0	4	392	0.0	0	0
65 - 70	95.2	3	267	-1,488,372	0	0	53,253.9	3	231	0.0	0	0
70 - 75	102.0	3	259	-1,594,685	0	0	57,057.7	3	233	0.0	0	0
75 - 80	108.8	2	147	-1,700,997	0	0	60,861.5	3	232	0.0	0	0
80 - 85	115.6	3	258	-1,807,309	0	0	64,665.4	2	154	0.0	0	0
85 - 90	122.4	1	97	-1,913,622	0	0	68,469.2	2	146	0.0	0	0
90 - 95	129.2	1	90	-2,019,934	0	0	72,273.1	1	89	0.0	0	0
95 - 100	136.0	6	537	-2,126,246	0	0	76,076.9	2	192	0.0	0	0
Hours Off	0.0	0	0	0	0	3,793	0.0	0	0	0.0	0	8,760

MAIN SYSTEM COOLING - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

PEAK COOLING LOADS
(Main System)

		Space							Coil						
Room Number	Description	Peak Time Mo/Hr	OA Cond. DB/WB (F)	Rm Dry Blb (F)	Supp. Dry Bulb (F)	Space Air Flow (Cfm)	Space Sens. Load (Btuh)	Space Lat. Load (Btuh)	Peak Time Mo/Hr	OA Cond. DB/WB (F)	Rm Dry Blb (F)	Supp. Dry Bulb (F)	Coil Air Flow (Cfm)	Coil Sens. Load (Btuh)	Coil Lat. Load (Btuh)
1	Z1-BSMT EAST	7/15	98 64	76	55.0	360	7,243	4,682	7/15	98 64	76	55.0	360	7,508	4,554
Zone	1 Total/Ave.		98 64	76	55.0	360	7,243	4,682		98 64	76	55.0	360	7,508	4,554
Zone	1 Block	7/15	98 64	76	55.0	360	7,243	4,682	7/15	98 64	76	55.0	360	7,508	4,554
2	Z1-1ST FLR EAST	7/16	97 64	76	55.0	1,147	23,065	1,676	7/16	97 64	76	55.0	1,247	26,335	1,269
Zone	2 Total/Ave.		97 64	76	55.0	1,147	23,065	1,676		97 64	76	55.0	1,247	26,335	1,269
Zone	2 Block	7/16	97 64	76	55.0	1,147	23,065	1,676	7/16	97 64	76	55.0	1,247	26,335	1,269
3	Z2-1ST FLR EAST	7/16	97 64	74	55.0	6,858	124,761	1,149	7/16	97 64	74	55.0	7,108	136,197	-1,285
Zone	3 Total/Ave.		97 64	74	55.0	6,858	124,761	1,149		97 64	74	55.0	7,108	136,197	-1,285
Zone	3 Block	7/16	97 64	74	55.0	6,858	124,761	1,149	7/16	97 64	74	55.0	7,108	136,197	-1,285
4	Z1-2ND FLR EAST	7/16	97 64	76	55.0	1,122	22,551	1,296	7/16	97 64	76	55.0	1,348	27,957	898
Zone	4 Total/Ave.		97 64	76	55.0	1,122	22,551	1,296		97 64	76	55.0	1,348	27,957	898
Zone	4 Block	7/16	97 64	76	55.0	1,122	22,551	1,296	7/16	97 64	76	55.0	1,348	27,957	898
5	Z2-2ND FLR EAST	7/16	97 64	74	55.0	2,890	52,575	1,909	7/16	97 64	74	55.0	3,358	63,070	883
Zone	5 Total/Ave.		97 64	74	55.0	2,890	52,575	1,909		97 64	74	55.0	3,358	63,070	883
Zone	5 Block	7/16	97 64	74	55.0	2,890	52,575	1,909	7/16	97 64	74	55.0	3,358	63,070	883
System	1 Total/Ave.		97 64	74	55.0	12,377	230,196	10,712		97 64	74	55.0	13,420	261,066	6,318
System	1 Block	7/16	97 64	74	55.0	12,374	230,153	10,712	7/16	97 64	74	55.0	13,418	265,201	6,318
6	Z1-BSMT WEST	7/15	98 64	76	55.0	252	5,077	2,680	7/15	98 64	76	55.0	251	5,590	2,643
Zone	6 Total/Ave.		98 64	76	55.0	252	5,077	2,680		98 64	76	55.0	251	5,590	2,643
Zone	6 Block	7/15	98 64	76	55.0	252	5,077	2,680	7/15	98 64	76	55.0	251	5,590	2,643
7	Z2-BSMT WEST	7/15	98 64	76	76.0	0	0	-16	7/15	98 64	76	76.0	0	0	-16
Zone	7 Total/Ave.		98 64	76	76.0	0	0	-16		98 64	76	76.0	0	0	-16
Zone	7 Block	7/15	98 64	76	76.0	0	0	-16	7/15	98 64	76	76.0	0	0	-16
8	Z1-1ST FLR WEST	7/16	97 64	76	55.0	1,403	28,209	1,427	7/16	97 64	76	55.0	1,597	33,408	1,220
Zone	8 Total/Ave.		97 64	76	55.0	1,403	28,209	1,427		97 64	76	55.0	1,597	33,408	1,220
Zone	8 Block	7/16	97 64	76	55.0	1,403	28,209	1,427	7/16	97 64	76	55.0	1,597	33,408	1,220
9	Z2-1ST FLR WEST	7/16	97 64	74	55.0	7,189	130,780	606	7/16	97 64	74	55.0	7,367	142,485	-453
Zone	9 Total/Ave.		97 64	74	55.0	7,189	130,780	606		97 64	74	55.0	7,367	142,485	-453
Zone	9 Block	7/16	97 64	74	55.0	7,189	130,780	606	7/16	97 64	74	55.0	7,367	142,485	-453
10	Z1-2ND FLR WEST	7/16	97 64	76	55.0	1,355	27,237	1,427	7/16	97 64	76	55.0	1,665	34,300	1,228
Zone	10 Total/Ave.		97 64	76	55.0	1,355	27,237	1,427		97 64	76	55.0	1,665	34,300	1,228
Zone	10 Block	7/16	97 64	76	55.0	1,355	27,237	1,427	7/16	97 64	76	55.0	1,665	34,300	1,228
11	Z2-2ND FLR WEST	7/16	97 64	74	55.0	10,823	196,903	2,126	7/16	97 64	74	55.0	11,236	213,448	532
Zone	11 Total/Ave.		97 64	74	55.0	10,823	196,903	2,126		97 64	74	55.0	11,236	213,448	532
Zone	11 Block	7/16	97 64	74	55.0	10,823	196,903	2,126	7/16	97 64	74	55.0	11,236	213,448	532
System	2 Total/Ave.		97 64	74	55.0	21,022	388,205	8,250		97 64	74	55.0	22,117	429,231	5,154
System	2 Block	7/16	97 64	74	55.0	20,843	384,909	8,250	7/16	97 64	74	55.0	21,939	432,290	5,154
12	Z3-BSMT SOUTH	7/15	98 64	76	55.0	171	3,447	2,882	7/15	98 64	76	55.0	170	3,622	2,847
Zone	12 Total/Ave.		98 64	76	55.0	171	3,447	2,882		98 64	76	55.0	170	3,622	2,847
Zone	12 Block	7/15	98 64	76	55.0	171	3,447	2,882	7/15	98 64	76	55.0	170	3,622	2,847
13	Z2-BSMT SOUTH	7/15	98 64	74	55.0	9,443	171,787	1,629	7/15	98 64	74	55.0	9,304	184,449	-297
Zone	13 Total/Ave.		98 64	74	55.0	9,443	171,787	1,629		98 64	74	55.0	9,304	184,449	-297
Zone	13 Block	7/15	98 64	74	55.0	9,443	171,787	1,629	7/15	98 64	74	55.0	9,304	184,449	-297
14	Z1-BSMT SOUTH	7/15	98 64	74	55.0	1,044	18,994	2,966	7/15	98 64	74	55.0	916	18,329	2,753
Zone	14 Total/Ave.		98 64	74	55.0	1,044	18,994	2,966		98 64	74	55.0	916	18,329	2,753

Zone	14	Block	7/15	98	64	74	55.0	1,044	18,994	2,966	7/15	98	64	74	55.0	916	18,329	2,753
	15	Z1-1ST FLR SOUTH	7/16	97	64	76	55.0	2,654	53,369	5,180	7/16	97	64	76	55.0	2,923	61,795	4,639
Zone	15	Total/Ave.		97	64	76	55.0	2,654	53,369	5,180		97	64	76	55.0	2,923	61,795	4,639

MAIN SYSTEM COOLING - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

PEAK COOLING LOADS
(Main System)

		Space							Coil						
Room Number	Description	Peak Time Mo/Hr	OA Cond. DB/WB (F)	Rm Dry Blb (F)	Supp. Dry Bulb (F)	Space Air Flow (Cfm)	Space Sens. Load (Btuh)	Space Lat. Load (Btuh)	Peak Time Mo/Hr	OA Cond. DB/WB (F)	Rm Dry Blb (F)	Supp. Dry Bulb (F)	Coil Air Flow (Cfm)	Coil Sens. Load (Btuh)	Coil Lat. Load (Btuh)
Zone	15 Block	7/16	97 64	76	55.0	2,654	53,369	5,180	7/16	97 64	76	55.0	2,923	61,795	4,639
16	Z2-1ST FLR SOUTH	7/12	93 62	76	55.0	5,263	105,825	3,125	7/12	93 62	76	55.0	5,430	114,518	2,052
Zone	16 Total/Ave.		93 62	76	55.0	5,263	105,825	3,125		93 62	76	55.0	5,430	114,518	2,052
Zone	16 Block	7/12	93 62	76	55.0	5,263	105,825	3,125	7/12	93 62	76	55.0	5,430	114,518	2,052
17	Z3-1ST FLR SOUTH	7/16	97 64	74	55.0	2,792	50,794	2,573	7/16	97 64	74	55.0	2,945	57,064	2,004
Zone	17 Total/Ave.		97 64	74	55.0	2,792	50,794	2,573		97 64	74	55.0	2,945	57,064	2,004
Zone	17 Block	7/16	97 64	74	55.0	2,792	50,794	2,573	7/16	97 64	74	55.0	2,945	57,064	2,004
18	Z3-2ND FLR SOUTH	7/16	97 64	74	55.0	10,321	187,763	2,575	7/16	97 64	74	55.0	11,188	212,225	470
Zone	18 Total/Ave.		97 64	74	55.0	10,321	187,763	2,575		97 64	74	55.0	11,188	212,225	470
Zone	18 Block	7/16	97 64	74	55.0	10,321	187,763	2,575	7/16	97 64	74	55.0	11,188	212,225	470
19	Z1-2ND FLR SOUTH	7/16	97 64	76	55.0	1,378	27,716	212	7/16	97 64	76	55.0	1,709	35,382	-69
Zone	19 Total/Ave.		97 64	76	55.0	1,378	27,716	212		97 64	76	55.0	1,709	35,382	-69
Zone	19 Block	7/16	97 64	76	55.0	1,378	27,716	212	7/16	97 64	76	55.0	1,709	35,382	-69
20	Z2-2ND FLR SOUTH	7/16	97 64	74	55.0	10,380	188,845	5,241	7/16	97 64	74	55.0	11,146	212,139	3,124
Zone	20 Total/Ave.		97 64	74	55.0	10,380	188,845	5,241		97 64	74	55.0	11,146	212,139	3,124
Zone	20 Block	7/16	97 64	74	55.0	10,380	188,845	5,241	7/16	97 64	74	55.0	11,146	212,139	3,124
System	3 Total/Ave.		97 64	74	55.0	43,447	808,540	26,384		97 64	74	55.0	45,731	899,523	17,523
System	3 Block	7/16	97 64	74	55.0	42,859	797,607	26,384	7/16	97 64	74	55.0	45,144	905,508	17,523

BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

July			------ Design -----		----- Weekday -----		----- Saturday----		------ Sunday -----		------ Monday -----	
Hour	OADB	OAWB	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton
1	79.5	63.5	0	83.5	0	82.7	0	97.8	0	90.7	0	89.0
2	77.5	62.1	0	78.8	0	79.1	0	88.0	0	84.5	0	82.9
3	75.7	61.1	0	75.0	0	75.4	0	83.1	0	80.0	0	78.5
4	74.4	60.2	0	71.3	0	72.2	0	78.9	0	76.2	0	74.7
5	73.6	60.9	0	68.4	0	69.1	0	75.2	0	72.8	0	71.3
6	73.4	61.6	0	66.1	0	67.4	0	73.4	0	71.1	0	69.5
7	73.9	62.1	0	64.5	0	65.8	0	71.4	0	69.3	0	67.6
8	75.4	61.8	0	72.2	0	72.2	0	69.0	0	67.2	0	73.8
9	77.9	62.6	0	97.8	0	100.2	0	69.1	0	67.4	0	102.5
10	80.9	63.8	0	109.0	0	115.9	0	73.1	0	71.3	0	118.6
11	84.3	64.4	0	123.4	0	129.3	0	75.1	0	73.6	0	130.8
12	87.6	65.8	0	134.8	0	136.0	0	81.0	0	79.3	0	136.0
13	90.7	66.9	0	136.0	0	136.0	0	85.4	0	83.9	0	136.0
14	93.1	67.6	0	136.0	0	136.0	0	90.2	0	88.7	0	136.0
15	94.6	68.3	0	136.0	0	136.0	0	94.8	0	93.3	0	136.0
16	95.1	68.6	0	136.0	0	136.0	0	98.3	0	96.9	0	136.0
17	94.9	68.4	0	136.0	0	136.0	0	101.9	0	100.6	0	136.0
18	94.1	67.9	0	136.0	0	136.0	0	103.8	0	102.6	0	136.0
19	92.8	67.8	0	136.0	0	136.0	0	106.1	0	105.0	0	136.0
20	91.0	66.7	0	120.1	0	136.0	0	106.0	0	105.0	0	136.0
21	89.0	66.7	0	110.4	0	121.2	0	104.1	0	103.2	0	125.2
22	86.7	66.5	0	102.0	0	115.0	0	103.8	0	103.0	0	115.0
23	84.3	66.1	0	94.5	0	113.2	0	101.1	0	100.5	0	113.2
24	81.8	65.0	0	89.5	0	108.8	0	95.8	0	95.2	0	109.7

August			------ Design -----		----- Weekday -----		----- Saturday----		------ Sunday -----		------ Monday -----	
Hour	OADB	OAWB	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton
1	77.6	62.9	0	92.4	0	79.1	0	90.9	0	84.4	0	82.6
2	75.5	62.1	0	78.1	0	76.7	0	85.7	0	79.8	0	78.2
3	73.8	61.5	0	72.5	0	72.7	0	80.4	0	75.4	0	73.8
4	72.5	61.0	0	68.5	0	69.5	0	76.1	0	71.8	0	70.2
5	71.6	61.2	0	65.1	0	66.4	0	71.9	0	68.6	0	67.0
6	71.4	61.8	0	62.3	0	63.9	0	68.3	0	66.1	0	64.4
7	71.9	62.1	0	60.9	0	62.0	0	65.5	0	64.1	0	62.4
8	73.5	63.0	0	68.7	0	71.0	0	66.0	0	64.7	0	71.4
9	75.9	63.2	0	96.2	0	98.5	0	65.1	0	63.8	0	98.9
10	79.0	64.2	0	109.8	0	111.7	0	67.0	0	65.7	0	112.0
11	82.4	65.0	0	125.3	0	126.3	0	70.4	0	69.2	0	126.5
12	85.8	66.1	0	135.8	0	135.8	0	74.7	0	73.4	0	135.5
13	88.9	67.1	0	136.0	0	136.0	0	80.9	0	79.5	0	136.0
14	91.3	67.7	0	136.0	0	136.0	0	85.1	0	83.7	0	136.0
15	92.9	67.5	0	136.0	0	136.0	0	89.4	0	88.1	0	136.0
16	93.4	67.4	0	136.0	0	136.0	0	93.4	0	92.2	0	136.0
17	93.1	67.0	0	136.0	0	136.0	0	96.5	0	95.3	0	136.0
18	92.3	66.7	0	136.0	0	136.0	0	97.6	0	96.6	0	136.0
19	91.0	66.7	0	135.3	0	136.0	0	99.7	0	98.7	0	136.0
20	89.2	66.5	0	114.9	0	130.0	0	100.5	0	99.5	0	135.5
21	87.2	66.5	0	110.0	0	114.3	0	99.4	0	98.5	0	114.6
22	84.8	66.3	0	101.0	0	113.0	0	97.9	0	97.1	0	113.3
23	82.4	65.7	0	90.3	0	110.7	0	94.7	0	94.0	0	110.9
24	79.9	64.4	0	84.6	0	102.3	0	89.4	0	88.8	0	100.6

COLD THERMAL STORAGE - ALTERNATIVE 1

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---- BUILDING COOLING DEMANDS AND THERMAL STORAGE ----

January

Hour	Design OADB (F)	Design OAWB (F)	Design Cooling Load (Ton)	Design Chiller Load (Ton)	Design Chiller Demand (kW)	Design Storage Capacity (Ton-Hr)
1	32.8	22.9	0.0	0.0	0.0	1,000
2	31.5	21.9	3.6	3.6	2.8	1,000
3	30.4	20.9	5.1	5.1	3.9	1,000
4	29.6	20.4	4.6	4.6	3.5	1,000
5	29.4	20.0	4.1	4.1	3.1	1,000
6	29.9	20.7	3.8	3.8	2.9	1,000
7	31.2	22.0	3.6	3.6	2.8	1,000
8	33.6	24.0	5.4	5.4	4.1	1,000
9	37.0	26.5	18.7	0.0	0.0	981
10	40.9	28.5	24.4	0.0	0.0	957
11	45.4	30.7	30.8	0.0	0.0	926
12	49.6	34.1	37.2	0.0	0.0	889
13	52.7	36.1	41.1	0.0	0.0	848
14	54.8	36.7	44.8	0.0	0.0	803
15	55.6	37.2	48.5	0.0	0.0	755
16	54.8	36.8	51.7	0.0	0.0	703
17	53.0	35.6	40.6	0.0	0.0	662
18	50.1	34.0	33.8	0.0	0.0	629
19	46.7	31.7	29.2	0.0	0.0	599
20	43.3	29.9	23.4	300.0	219.0	876
21	40.4	28.1	20.0	144.0	114.6	1,000
22	37.8	26.4	17.3	17.3	13.1	1,000
23	35.7	24.9	14.4	14.4	11.0	1,000
24	34.1	23.9	11.3	11.3	8.6	1,000

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
1	36.9	28.0	10.6	10.6	8.1	1,000	10.7	10.7	8.2	1,000
2	34.1	25.7	8.2	8.2	6.2	1,000	8.2	8.2	6.3	1,000
3	31.6	23.5	6.3	6.3	4.8	1,000	6.6	6.6	5.0	1,000
4	29.5	21.9	4.9	4.9	3.7	1,000	4.9	4.9	3.8	1,000
5	28.0	20.5	4.3	4.3	3.3	1,000	4.4	4.4	3.4	1,000
6	27.0	20.1	3.9	3.9	3.0	1,000	4.0	4.0	3.1	1,000
7	26.7	20.4	3.6	3.6	2.8	1,000	3.7	3.7	2.8	1,000
8	27.3	21.4	4.4	4.4	3.4	1,000	3.3	3.3	2.5	1,000
9	29.2	23.1	16.3	0.0	0.0	984	3.4	0.0	0.0	997
10	32.1	24.4	20.8	0.0	0.0	963	3.6	0.0	0.0	993
11	35.8	26.3	25.9	0.0	0.0	937	3.7	0.0	0.0	989
12	39.8	28.8	31.2	0.0	0.0	906	4.2	0.0	0.0	985
13	43.9	31.5	34.2	0.0	0.0	872	6.6	0.0	0.0	978
14	47.5	33.8	37.7	0.0	0.0	834	9.5	0.0	0.0	969
15	50.4	35.9	41.1	0.0	0.0	793	12.3	0.0	0.0	957
16	52.3	37.3	44.2	0.0	0.0	748	14.7	0.0	0.0	942
17	52.9	37.7	33.9	0.0	0.0	715	16.7	0.0	0.0	925

COLD THERMAL STORAGE - ALTERNATIVE 1

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---- B U I L D I N G   C O O L I N G   D E M A N D S   A N D   T H E R M A L   S T O R A G E ----

April

Hour	Design OADB (F)	Design OAWB (F)	Design Cooling Load (Ton)	Design Chiller Load (Ton)	Design Chiller Demand (kW)	Design Storage Capacity (Ton-Hr)
1	58.1	38.1	38.3	38.3	27.6	1,000
2	56.8	37.7	35.5	35.5	25.8	1,000
3	55.8	37.2	33.4	33.4	24.5	1,000
4	55.1	36.9	31.4	31.4	23.2	1,000
5	54.8	37.0	29.8	29.8	22.1	1,000
6	55.3	37.6	28.8	28.8	21.5	1,000
7	56.6	39.2	28.5	28.5	21.3	1,000
8	58.8	40.0	33.0	33.0	24.2	1,000
9	62.1	41.3	48.3	0.0	0.0	952
10	65.8	42.9	55.0	0.0	0.0	897
11	70.1	45.3	63.0	0.0	0.0	834
12	74.1	47.5	71.5	0.0	0.0	762
13	77.1	49.2	82.7	0.0	0.0	679
14	79.1	50.3	90.1	0.0	0.0	589
15	79.8	50.5	95.8	0.0	0.0	493
16	79.1	49.5	103.0	0.0	0.0	390
17	77.3	48.5	87.2	0.0	0.0	303
18	74.6	46.8	76.9	0.0	0.0	226
19	71.3	45.2	70.0	0.0	0.0	156
20	68.1	44.0	62.2	300.0	221.7	394
21	65.3	42.6	57.6	300.0	221.7	637
22	62.8	41.2	53.9	300.0	222.0	883
23	60.8	40.2	49.1	166.4	126.5	1,000
24	59.3	39.1	45.3	45.3	32.1	1,000

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
1	60.6	41.7	39.2	39.2	28.2	1,000	39.6	39.6	28.4	1,000
2	58.2	40.7	36.7	36.7	26.5	1,000	37.0	37.0	26.7	1,000
3	56.1	39.5	34.4	34.4	25.1	1,000	34.7	34.7	25.3	1,000
4	54.4	38.6	32.5	32.5	23.9	1,000	32.9	32.9	24.1	1,000
5	53.1	38.1	30.5	30.5	22.6	1,000	30.9	30.9	22.8	1,000
6	52.3	38.1	28.9	28.9	21.6	1,000	29.4	29.4	21.8	1,000
7	52.0	39.1	27.6	27.6	20.7	1,000	28.0	28.0	21.0	1,000
8	52.8	38.7	31.2	31.2	23.0	1,000	27.2	27.2	20.4	1,000
9	54.9	39.2	46.0	0.0	0.0	954	27.2	0.0	0.0	973
10	58.2	40.5	51.9	0.0	0.0	902	28.0	0.0	0.0	945
11	62.3	43.0	58.7	0.0	0.0	843	29.7	0.0	0.0	915
12	66.7	45.8	66.5	0.0	0.0	777	32.2	0.0	0.0	883
13	70.7	48.3	73.7	0.0	0.0	703	34.9	0.0	0.0	848
14	74.1	50.5	81.8	0.0	0.0	621	37.8	0.0	0.0	810
15	76.2	51.5	87.4	0.0	0.0	534	40.4	0.0	0.0	770
16	77.0	51.0	91.6	0.0	0.0	443	42.4	0.0	0.0	727
17	76.7	50.7	73.5	0.0	0.0	369	44.0	0.0	0.0	683

D14-19

COLD THERMAL STORAGE - ALTERNATIVE 1

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	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
18	52.6	37.9	27.9	0.0	0.0	687	18.0	0.0	0.0	907
19	51.6	38.7	24.8	0.0	0.0	662	19.1	0.0	0.0	888
20	50.1	38.3	20.7	300.0	219.0	941	19.3	131.1	108.5	1,000
21	48.0	37.0	18.7	77.5	58.8	1,000	18.5	18.5	14.1	1,000
22	45.5	35.2	17.1	17.1	13.0	1,000	17.0	17.0	12.9	1,000
23	42.7	32.9	14.6	14.6	11.1	1,000	14.7	14.7	11.2	1,000
24	39.8	30.3	12.5	12.5	9.5	1,000	12.6	12.6	9.6	1,000

	Typical		Sunday				Monday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	36.9	28.0	10.5	10.5	8.0	1,000	10.1	10.1	7.7	1,000
2	34.1	25.7	8.0	8.0	6.1	1,000	7.6	7.6	5.8	1,000
3	31.6	23.5	6.4	6.4	4.9	1,000	6.0	6.0	4.6	1,000
4	29.5	21.9	4.9	4.9	3.7	1,000	4.8	4.8	3.6	1,000
5	28.0	20.5	4.3	4.3	3.3	1,000	4.2	4.2	3.2	1,000
6	27.0	20.1	4.0	4.0	3.0	1,000	3.9	3.9	2.9	1,000
7	26.7	20.4	3.7	3.7	2.8	1,000	3.6	3.6	2.7	1,000
8	27.3	21.4	3.3	3.3	2.5	1,000	4.3	4.3	3.3	1,000
9	29.2	23.1	3.4	0.0	0.0	997	16.2	0.0	0.0	984
10	32.1	24.4	3.5	0.0	0.0	993	20.8	0.0	0.0	963
11	35.8	26.3	3.7	0.0	0.0	989	25.9	0.0	0.0	937
12	39.8	28.8	4.2	0.0	0.0	985	31.2	0.0	0.0	906
13	43.9	31.5	6.6	0.0	0.0	979	34.2	0.0	0.0	872
14	47.5	33.8	9.5	0.0	0.0	969	37.7	0.0	0.0	834
15	50.4	35.9	12.2	0.0	0.0	957	41.1	0.0	0.0	793
16	52.3	37.3	14.7	0.0	0.0	942	44.2	0.0	0.0	749
17	52.9	37.7	16.6	0.0	0.0	926	33.9	0.0	0.0	715
18	52.6	37.9	18.0	0.0	0.0	908	27.9	0.0	0.0	687
19	51.6	38.7	19.1	0.0	0.0	888	24.8	0.0	0.0	662
20	50.1	38.3	19.3	130.9	108.3	1,000	20.7	300.0	219.0	941
21	48.0	37.0	18.5	18.5	14.1	1,000	18.7	77.4	58.7	1,000
22	45.5	35.2	17.0	17.0	12.9	1,000	17.1	17.1	13.0	1,000
23	42.7	32.9	14.7	14.7	11.2	1,000	14.6	14.6	11.1	1,000
24	39.8	30.3	12.6	12.6	9.6	1,000	12.5	12.5	9.5	1,000

COLD THERMAL STORAGE - ALTERNATIVE 1

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	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
18	75.9	49.8	63.5	0.0	0.0	306	45.2	0.0	0.0	638
19	74.6	49.3	57.2	0.0	0.0	248	45.8	0.0	0.0	592
20	72.8	49.4	50.4	300.0	224.3	498	45.7	300.0	224.3	847
21	70.7	48.5	48.2	300.0	223.6	750	45.4	198.7	146.7	1,000
22	68.3	47.1	46.6	296.8	220.0	1,000	44.1	44.1	31.3	1,000
23	65.8	45.8	44.3	44.3	31.5	1,000	42.3	42.3	30.1	1,000
24	63.2	43.8	41.6	41.6	29.7	1,000	40.2	40.2	28.8	1,000

	Typical		Sunday				Monday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	60.6	41.7	37.9	37.9	27.4	1,000	37.2	37.2	26.9	1,000
2	58.2	40.7	35.7	35.7	25.9	1,000	34.9	34.9	25.4	1,000
3	56.1	39.5	33.6	33.6	24.5	1,000	32.8	32.8	24.1	1,000
4	54.4	38.6	31.8	31.8	23.4	1,000	31.1	31.1	22.9	1,000
5	53.1	38.1	30.0	30.0	22.2	1,000	29.2	29.2	21.8	1,000
6	52.3	38.1	28.5	28.5	21.3	1,000	27.8	27.8	20.8	1,000
7	52.0	39.1	27.3	27.3	20.5	1,000	26.5	26.5	20.0	1,000
8	52.8	38.7	26.5	26.5	20.0	1,000	30.2	30.2	22.4	1,000
9	54.9	39.2	26.6	0.0	0.0	973	44.7	0.0	0.0	955
10	58.2	40.5	27.5	0.0	0.0	946	50.5	0.0	0.0	905
11	62.3	43.0	29.2	0.0	0.0	917	57.4	0.0	0.0	847
12	66.7	45.8	31.8	0.0	0.0	885	64.2	0.0	0.0	783
13	70.7	48.3	34.4	0.0	0.0	851	67.9	0.0	0.0	715
14	74.1	50.5	37.4	0.0	0.0	813	74.5	0.0	0.0	641
15	76.2	51.5	39.9	0.0	0.0	773	83.4	0.0	0.0	557
16	77.0	51.0	42.0	0.0	0.0	731	87.8	0.0	0.0	470
17	76.7	50.7	43.6	0.0	0.0	688	72.9	0.0	0.0	397
18	75.9	49.8	44.8	0.0	0.0	643	63.1	0.0	0.0	334
19	74.6	49.3	45.4	0.0	0.0	597	56.8	0.0	0.0	277
20	72.8	49.4	45.4	300.0	224.3	852	50.1	300.0	224.3	527
21	70.7	48.5	45.1	193.0	143.3	1,000	47.9	300.0	223.6	779
22	68.3	47.1	43.8	43.8	31.1	1,000	46.3	267.5	194.1	1,000
23	65.8	45.8	42.0	42.0	30.0	1,000	44.1	44.1	31.3	1,000
24	63.2	43.8	39.9	39.9	28.6	1,000	41.6	41.6	29.7	1,000

COLD THERMAL STORAGE - ALTERNATIVE 1

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---- BUILDING COOLING DEMANDS AND THERMAL STORAGE ----

July

Hour	Design OADB (F)	Design OAWB (F)	Design Cooling Load (Ton)	Design Chiller Load (Ton)	Design Chiller Demand (kW)	Design Storage Capacity (Ton-Hr)
1	79.1	56.4	83.5	83.5	58.9	1,000
2	78.0	55.8	78.8	78.8	54.9	1,000
3	77.2	55.5	75.0	75.0	51.8	1,000
4	76.5	55.1	71.3	71.3	48.9	1,000
5	76.3	55.9	68.4	68.4	47.0	1,000
6	76.7	56.8	66.1	66.1	45.8	1,000
7	77.8	57.7	64.5	64.5	45.1	1,000
8	79.8	57.9	72.2	72.2	50.9	1,000
9	82.6	59.0	97.8	0.0	0.0	902
10	85.8	60.3	109.0	0.0	0.0	793
11	89.5	61.3	123.4	0.0	0.0	670
12	93.0	62.7	134.8	0.0	0.0	535
13	95.6	63.5	136.0	0.0	0.0	399
14	97.3	63.9	136.0	0.0	0.0	263
15	98.0	64.0	136.0	0.0	0.0	127
16	97.3	63.6	136.0	8.9	7.2	0
17	95.8	62.6	136.0	136.0	108.8	0
18	93.4	61.3	136.0	136.0	107.4	0
19	90.6	60.1	136.0	136.0	106.1	0
20	87.8	58.5	120.1	300.0	235.8	180
21	85.4	57.9	110.4	300.0	234.8	370
22	83.2	57.5	102.0	300.0	234.2	568
23	81.5	57.3	94.5	300.0	233.9	773
24	80.2	56.9	89.5	300.0	233.3	984

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
1	79.5	63.5	82.7	99.1	84.4	1,000	97.8	192.0	154.1	1,000
2	77.5	62.1	79.1	79.1	58.6	1,000	88.0	88.0	65.7	1,000
3	75.7	61.1	75.4	75.4	55.1	1,000	83.1	83.1	61.2	1,000
4	74.4	60.2	72.2	72.2	52.1	1,000	78.9	78.9	57.3	1,000
5	73.6	60.9	69.1	69.1	50.1	1,000	75.2	75.2	54.8	1,000
6	73.4	61.6	67.4	67.4	49.2	1,000	73.4	73.4	53.8	1,000
7	73.9	62.1	65.8	65.8	48.2	1,000	71.4	71.4	52.5	1,000
8	75.4	61.8	72.2	72.2	53.0	1,000	69.0	69.0	50.6	1,000
9	77.9	62.6	100.2	0.0	0.0	900	69.1	0.0	0.0	931
10	80.9	63.8	115.9	0.0	0.0	784	73.1	0.0	0.0	858
11	84.3	64.4	129.3	0.0	0.0	655	75.1	0.0	0.0	783
12	87.6	65.8	136.0	0.0	0.0	519	81.0	0.0	0.0	702
13	90.7	66.9	136.0	0.0	0.0	383	85.4	0.0	0.0	616
14	93.1	67.6	136.0	0.0	0.0	247	90.2	0.0	0.0	526
15	94.6	68.3	136.0	0.0	0.0	111	94.8	0.0	0.0	431
16	95.1	68.6	136.0	25.4	21.9	0	98.3	0.0	0.0	333
17	94.9	68.4	136.0	136.0	115.4	0	101.9	0.0	0.0	231

COLD THERMAL STORAGE - ALTERNATIVE 1

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	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
18	94.1	67.9	136.0	136.0	114.8	0	103.8	0.0	0.0	127
19	92.8	67.8	136.0	136.0	114.7	0	106.1	0.0	0.0	21
20	91.0	66.7	136.0	300.0	251.5	164	106.0	300.0	251.5	215
21	89.0	66.7	121.2	300.0	251.5	343	104.1	300.0	251.5	411
22	86.7	66.5	115.0	300.0	251.0	528	103.8	300.0	251.0	607
23	84.3	66.1	113.2	300.0	250.2	715	101.1	300.0	250.2	806
24	81.8	65.0	108.8	300.0	247.9	906	95.8	289.5	237.6	1,000

	Typical		Sunday				Monday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	79.5	63.5	90.7	90.7	68.8	1,000	89.0	89.0	67.5	1,000
2	77.5	62.1	84.5	84.5	62.9	1,000	82.9	82.9	61.6	1,000
3	75.7	61.1	80.0	80.0	58.7	1,000	78.5	78.5	57.5	1,000
4	74.4	60.2	76.2	76.2	55.2	1,000	74.7	74.7	54.0	1,000
5	73.6	60.9	72.8	72.8	53.0	1,000	71.3	71.3	51.8	1,000
6	73.4	61.6	71.1	71.1	52.0	1,000	69.5	69.5	50.8	1,000
7	73.9	62.1	69.3	69.3	50.9	1,000	67.6	67.6	49.6	1,000
8	75.4	61.8	67.2	67.2	49.2	1,000	73.8	73.8	54.3	1,000
9	77.9	62.6	67.4	0.0	0.0	933	102.5	0.0	0.0	897
10	80.9	63.8	71.3	0.0	0.0	861	118.6	0.0	0.0	779
11	84.3	64.4	73.6	0.0	0.0	788	130.8	0.0	0.0	648
12	87.6	65.8	79.3	0.0	0.0	708	136.0	0.0	0.0	512
13	90.7	66.9	83.9	0.0	0.0	624	136.0	0.0	0.0	376
14	93.1	67.6	88.7	0.0	0.0	536	136.0	0.0	0.0	240
15	94.6	68.3	93.3	0.0	0.0	442	136.0	0.0	0.0	104
16	95.1	68.6	96.9	0.0	0.0	346	136.0	32.0	26.7	0
17	94.9	68.4	100.6	0.0	0.0	245	136.0	136.0	115.4	0
18	94.1	67.9	102.6	0.0	0.0	142	136.0	136.0	114.8	0
19	92.8	67.8	105.0	0.0	0.0	37	136.0	136.0	114.7	0
20	91.0	66.7	105.0	300.0	251.5	232	136.0	300.0	251.5	164
21	89.0	66.7	103.2	300.0	251.5	429	125.2	300.0	251.5	339
22	86.7	66.5	103.0	300.0	251.0	626	115.0	300.0	251.0	524
23	84.3	66.1	100.5	300.0	250.2	826	113.2	300.0	250.2	711
24	81.8	65.0	95.2	269.7	218.3	1,000	109.7	300.0	247.9	901

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

COLD THERMAL STORAGE - ALTERNATIVE 1

---- B U I L D I N G   C O O L I N G   D E M A N D S   A N D   T H E R M A L   S T O R A G E ----

August

Hour	Design OADB (F)	Design OAWB (F)	Design Cooling Load (Ton)	Design Chiller Load (Ton)	Design Chiller Demand (kW)	Design Storage Capacity (Ton-Hr)
1	77.2	55.7	92.4	191.6	145.5	1,000
2	76.1	55.5	78.1	78.1	54.2	1,000
3	75.2	55.4	72.5	72.5	49.9	1,000
4	74.5	55.4	68.5	68.5	47.0	1,000
5	74.3	55.9	65.1	65.1	44.8	1,000
6	74.7	56.7	62.3	62.3	43.0	1,000
7	75.8	57.4	60.9	60.9	42.2	1,000
8	77.8	58.5	68.7	68.7	48.6	1,000
9	80.7	59.3	96.2	0.0	0.0	904
10	84.0	60.5	109.8	0.0	0.0	794
11	87.7	61.6	125.3	0.0	0.0	669
12	91.2	62.8	135.8	0.0	0.0	533
13	93.9	63.5	136.0	0.0	0.0	397
14	95.6	63.8	136.0	0.0	0.0	261
15	96.3	63.3	136.0	0.0	0.0	125
16	95.6	62.6	136.0	11.1	8.8	0
17	94.1	61.5	136.0	136.0	107.6	0
18	91.7	60.3	136.0	136.0	106.4	0
19	88.8	59.1	135.3	135.3	105.2	0
20	86.0	58.0	114.9	300.0	235.0	185
21	83.5	57.4	110.0	300.0	234.0	375
22	81.3	57.0	101.0	300.0	233.4	574
23	79.6	56.6	90.3	300.0	232.8	784
24	78.3	56.2	84.6	300.0	232.2	999

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
1	77.6	62.9	79.1	80.0	66.7	1,000	90.9	161.1	134.9	1,000
2	75.5	62.1	76.7	76.7	56.7	1,000	85.7	85.7	63.9	1,000
3	73.8	61.5	72.7	72.7	53.2	1,000	80.4	80.4	59.2	1,000
4	72.5	61.0	69.5	69.5	50.5	1,000	76.1	76.1	55.6	1,000
5	71.6	61.2	66.4	66.4	48.2	1,000	71.9	71.9	52.5	1,000
6	71.4	61.8	63.9	63.9	46.7	1,000	68.3	68.3	50.0	1,000
7	71.9	62.1	62.0	62.0	45.4	1,000	65.5	65.5	48.1	1,000
8	73.5	63.0	71.0	71.0	52.7	1,000	66.0	66.0	48.9	1,000
9	75.9	63.2	98.5	0.0	0.0	902	65.1	0.0	0.0	935
10	79.0	64.2	111.7	0.0	0.0	790	67.0	0.0	0.0	868
11	82.4	65.0	126.3	0.0	0.0	663	70.4	0.0	0.0	798
12	85.8	66.1	135.8	0.0	0.0	528	74.7	0.0	0.0	723
13	88.9	67.1	136.0	0.0	0.0	392	80.9	0.0	0.0	642
14	91.3	67.7	136.0	0.0	0.0	256	85.1	0.0	0.0	557
15	92.9	67.5	136.0	0.0	0.0	120	89.4	0.0	0.0	467
16	93.4	67.4	136.0	16.3	13.9	0	93.4	0.0	0.0	374
17	93.1	67.0	136.0	136.0	113.7	0	96.5	0.0	0.0	278

COLD THERMAL STORAGE - ALTERNATIVE 1

			Weekday				Saturday			
	Typical									
	OADB	OAWB	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
18	92.3	66.7	136.0	136.0	113.4	0	97.6	0.0	0.0	180
19	91.0	66.7	136.0	136.0	113.4	0	99.7	0.0	0.0	80
20	89.2	66.5	130.0	300.0	251.0	170	100.5	300.0	251.0	280
21	87.2	66.5	114.3	300.0	251.0	356	99.4	300.0	251.0	480
22	84.8	66.3	113.0	300.0	250.6	543	97.9	300.0	250.6	683
23	82.4	65.7	110.7	300.0	249.4	732	94.7	300.0	249.4	888
24	79.9	64.4	102.3	300.0	246.7	930	89.4	201.6	161.9	1,000

			Sunday				Monday			
	Typical									
	OADB	OAWB	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	77.6	62.9	84.4	84.4	63.3	1,000	82.6	82.6	61.9	1,000
2	75.5	62.1	79.8	79.8	59.2	1,000	78.2	78.2	57.8	1,000
3	73.8	61.5	75.4	75.4	55.3	1,000	73.8	73.8	54.0	1,000
4	72.5	61.0	71.8	71.8	52.3	1,000	70.2	70.2	51.0	1,000
5	71.6	61.2	68.6	68.6	49.9	1,000	67.0	67.0	48.7	1,000
6	71.4	61.8	66.1	66.1	48.3	1,000	64.4	64.4	47.0	1,000
7	71.9	62.1	64.1	64.1	46.9	1,000	62.4	62.4	45.7	1,000
8	73.5	63.0	64.7	64.7	47.9	1,000	71.4	71.4	53.0	1,000
9	75.9	63.2	63.8	0.0	0.0	936	98.9	0.0	0.0	901
10	79.0	64.2	65.7	0.0	0.0	870	112.0	0.0	0.0	789
11	82.4	65.0	69.2	0.0	0.0	801	126.5	0.0	0.0	663
12	85.8	66.1	73.4	0.0	0.0	728	135.5	0.0	0.0	527
13	88.9	67.1	79.5	0.0	0.0	648	136.0	0.0	0.0	391
14	91.3	67.7	83.7	0.0	0.0	565	136.0	0.0	0.0	255
15	92.9	67.5	88.1	0.0	0.0	477	136.0	0.0	0.0	119
16	93.4	67.4	92.2	0.0	0.0	384	136.0	16.8	14.3	0
17	93.1	67.0	95.3	0.0	0.0	289	136.0	136.0	113.7	0
18	92.3	66.7	96.6	0.0	0.0	192	136.0	136.0	113.4	0
19	91.0	66.7	98.7	0.0	0.0	94	136.0	136.0	113.4	0
20	89.2	66.5	99.5	300.0	251.0	294	135.5	300.0	251.0	164
21	87.2	66.5	98.5	300.0	251.0	496	114.6	300.0	251.0	350
22	84.8	66.3	97.1	300.0	250.6	699	113.3	300.0	250.6	537
23	82.4	65.7	94.0	300.0	249.4	905	110.9	300.0	249.4	726
24	79.9	64.4	88.8	184.3	150.6	1,000	100.6	300.0	246.7	925

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

COLD THERMAL STORAGE - ALTERNATIVE 1

1 0

---- B U I L D I N G   C O O L I N G   D E M A N D S   A N D   T H E R M A L   S T O R A G E ----

October

Hour	Design OADB (F)	Design OAWB (F)	Design Cooling Load (Ton)	Design Chiller Load (Ton)	Design Chiller Demand (kW)	Design Storage Capacity (Ton-Hr)
1	56.1	41.7	40.0	40.0	28.7	1,000
2	54.7	41.2	36.8	36.8	26.6	1,000
3	53.6	40.3	34.1	34.1	24.9	1,000
4	52.8	40.2	31.7	31.7	23.3	1,000
5	52.5	40.0	30.0	30.0	22.3	1,000
6	53.1	40.6	28.7	28.7	21.4	1,000
7	54.5	41.8	28.0	28.0	21.0	1,000
8	57.0	43.5	32.7	32.7	24.0	1,000
9	60.6	44.3	48.7	0.0	0.0	951
10	64.8	46.1	55.3	0.0	0.0	896
11	69.5	48.5	63.6	0.0	0.0	833
12	74.0	50.9	77.9	0.0	0.0	755
13	77.3	52.7	85.1	0.0	0.0	670
14	79.6	53.5	93.2	0.0	0.0	576
15	80.4	53.7	102.7	0.0	0.0	474
16	79.6	52.7	108.6	0.0	0.0	365
17	77.6	51.3	91.2	0.0	0.0	274
18	74.5	49.8	80.6	0.0	0.0	193
19	70.9	49.0	73.4	0.0	0.0	120
20	67.3	48.1	64.3	300.0	223.3	356
21	64.2	46.6	58.6	300.0	222.5	597
22	61.4	44.8	53.4	300.0	221.8	844
23	59.2	43.3	48.1	204.4	149.5	1,000
24	57.5	42.4	43.2	43.2	30.7	1,000

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
1	59.3	49.3	41.0	41.0	29.4	1,000	41.7	41.7	29.8	1,000
2	56.6	47.8	37.8	37.8	27.3	1,000	38.3	38.3	27.6	1,000
3	54.3	45.7	35.3	35.3	25.6	1,000	35.8	35.8	26.0	1,000
4	52.3	44.9	32.9	32.9	24.1	1,000	33.4	33.4	24.4	1,000
5	50.9	43.7	30.7	30.7	22.7	1,000	31.2	31.2	23.0	1,000
6	50.0	43.2	28.9	28.9	21.5	1,000	29.5	29.5	21.9	1,000
7	49.7	43.1	27.5	27.5	20.6	1,000	28.1	28.1	21.0	1,000
8	50.5	43.6	30.7	30.7	22.7	1,000	26.8	26.8	20.2	1,000
9	52.9	43.1	45.7	0.0	0.0	954	26.9	0.0	0.0	973
10	56.6	44.6	51.4	0.0	0.0	903	27.5	0.0	0.0	946
11	61.2	47.1	58.9	0.0	0.0	844	29.5	0.0	0.0	916
12	66.0	50.1	67.3	0.0	0.0	777	32.4	0.0	0.0	884
13	70.6	53.0	76.3	0.0	0.0	700	36.2	0.0	0.0	847
14	74.3	54.8	83.7	0.0	0.0	617	39.9	0.0	0.0	808
15	76.7	56.1	92.2	0.0	0.0	525	43.4	0.0	0.0	764
16	77.6	56.0	98.1	0.0	0.0	426	46.1	0.0	0.0	718
17	77.3	55.4	80.9	0.0	0.0	345	48.5	0.0	0.0	670

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COLD THERMAL STORAGE - ALTERNATIVE 1

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	Typical		Weekday				Saturday			
	OADB	OAWB	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
18	76.3	55.3	71.4	0.0	0.0	274	50.2	0.0	0.0	619
19	74.9	56.7	65.8	0.0	0.0	208	51.2	0.0	0.0	568
20	72.9	57.7	58.8	300.0	234.5	449	51.5	300.0	234.5	817
21	70.6	57.0	55.3	300.0	233.4	694	51.4	234.7	175.3	1,000
22	67.9	55.0	52.0	300.0	230.5	942	49.7	49.7	34.9	1,000
23	65.1	52.9	48.5	106.3	87.4	1,000	47.1	47.1	33.2	1,000
24	62.1	51.0	44.2	44.2	31.4	1,000	43.4	43.4	30.9	1,000

	Typical		Sunday				Monday			
	OADB	OAWB	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	59.3	49.3	40.5	40.5	29.0	1,000	39.8	39.8	28.6	1,000
2	56.6	47.8	37.4	37.4	27.0	1,000	36.7	36.7	26.6	1,000
3	54.3	45.7	35.0	35.0	25.5	1,000	34.3	34.3	25.0	1,000
4	52.3	44.9	32.7	32.7	24.0	1,000	32.1	32.1	23.6	1,000
5	50.9	43.7	30.6	30.6	22.6	1,000	30.0	30.0	22.2	1,000
6	50.0	43.2	29.0	29.0	21.6	1,000	28.3	28.3	21.1	1,000
7	49.7	43.1	27.6	27.6	20.7	1,000	26.9	26.9	20.3	1,000
8	50.5	43.6	26.4	26.4	19.9	1,000	30.2	30.2	22.4	1,000
9	52.9	43.1	26.5	0.0	0.0	974	45.1	0.0	0.0	955
10	56.6	44.6	27.1	0.0	0.0	946	50.7	0.0	0.0	904
11	61.2	47.1	29.2	0.0	0.0	917	58.0	0.0	0.0	846
12	66.0	50.1	32.1	0.0	0.0	885	66.5	0.0	0.0	780
13	70.6	53.0	36.0	0.0	0.0	849	74.7	0.0	0.0	705
14	74.3	54.8	39.6	0.0	0.0	809	83.2	0.0	0.0	622
15	76.7	56.1	43.2	0.0	0.0	766	90.5	0.0	0.0	531
16	77.6	56.0	45.8	0.0	0.0	720	98.1	0.0	0.0	433
17	77.3	55.4	48.2	0.0	0.0	672	82.4	0.0	0.0	351
18	76.3	55.3	50.0	0.0	0.0	622	72.0	0.0	0.0	279
19	74.9	56.7	51.0	0.0	0.0	571	66.0	0.0	0.0	213
20	72.9	57.7	51.0	300.0	234.5	820	59.1	300.0	234.5	454
21	70.6	57.0	51.2	231.0	172.4	1,000	55.6	300.0	233.4	698
22	67.9	55.0	49.4	49.4	34.7	1,000	52.2	300.0	230.5	946
23	65.1	52.9	46.9	46.9	33.1	1,000	48.4	100.0	78.4	997
24	62.1	51.0	43.3	43.3	30.8	1,000	44.2	44.2	31.4	1,000

JOB WSMR ESOS STUDY EMC# 1110-000

SHEET NO. 1 OF 2

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY TF DATE 10-20-92

CHECKED BY ______ DATE ______

SCALE ______

P-300 THERMAL STORAGE SIZING FOR NEW MODIFIED CONFIGURATION

TRACE 600 RESULTS

	Total BLDG CONSUMPTION (kWh)	ELEC. ENERGY SAVINGS (kWh)	CHW EQUPMT ON-PEAK DEMAND (kW)	DEMAND REDUCTION (kW)
MODIFIED CONFIGURATION w/o TH. STORAGE	3,279,396	—	1463.5	—
1500 ton-hr storage	3,283,663	(4,267)	0	1463.5
1000 ton-hr storage	3,285,543	(6,147)	328.8	1134.7
500 ton-hr storage	3,294,041	(14,645)	740	720.7

~~REBATE CALCULATION: (ON PEAK = 10:00 a.m – 8:00 p.m)~~

~~CHILLER COMPRESSOR LOAD (kW) AT JULY DESIGN PEAK LESS MAXIMUM COMPRESSOR LOAD DURING ON PEAK PERIOD)~~

~~JULY DESIGN PEAK CHILLER LOAD = 115.4 kW (July, monday, hour 17)~~

~~REBATE = 115.4 kW × \$190/kW = \$21,926 ≃ \$22,000~~

JOB	
SHEET NO.	2 OF 2
CALCULATED BY	TF DATE 10-20-92
CHECKED BY	DATE
SCALE	

E M C ENGINEERS, INC.

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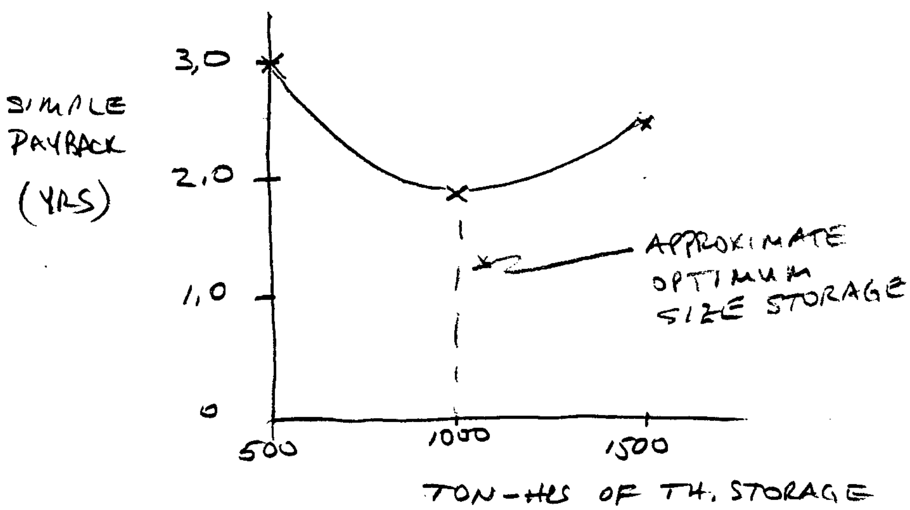
TH. STG CAPACITY	ENERGY COST SAVINGS	DEMAND COST SVGS	CONSTR. COST	REBATE	SIMPLE PAYBACK
500 ton-hr	(#324)	#14,112	#41,250	0 *	3.0 YRS
1000 "	(#136)	#22,127	#82,500	#22,000	1.9
1500 "	(#94)	#28,538	#123,750	#22,000	2.5



APPROXIMATELY 1000 TON-HRS IS THE OPTIMUM STORAGE SIZE.

* THE 500 TON-HR STORAGE SYSTEM DOES NOT CARRY THE PEAK COOLING LOAD IN JULY & AUGUST, SO DOES NOT QUALIFY FOR THE UTILITY REBATE.

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 MODIFIED CONFIGURATION WITHOUT THERMAL STORAGE

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	237,896	514	4,478	47	12
Feb	217,350	518	3,581	48	11
March	254,879	553	1,645	90	6
April	257,323	611	482	129	3
May	295,498	644	95	197	2
June	302,610	666	0	242	0
July	329,801	677	0	293	0
Aug	332,016	675	0	289	0
Sept	293,672	648	33	221	1
Oct	273,498	619	552	143	2
Nov	242,964	550	1,814	84	6
Dec	241,890	520	3,442	60	8
Total	3,279,396	677	16,123	1,843	12

Building Energy Consumption = 210,467 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 211,287 (Btu/Sq Ft/Year)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N ------------------------------------

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS													
	ELEC	16830	15222	18120	16079	17475	17369	16185	18120	16079	17475	16079	16185	201,220
	PK	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3
1	MISC LD													
	ELEC	129522	117009	130910	125119	130216	126508	128827	130910	125119	130215	125119	128827	1,528,301
	PK	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1070L	WTR-CLD RECIP >30 TONS												
	ELEC	9109	9188	16987	23691	30479	33845	32967	34604	31556	26426	15863	11475	276,189
	PK	36.2	38.6	52.7	66.1	71.2	70.5	78.8	78.5	72.0	70.4	51.7	39.4	78.8
1	EQ5101	COOLING TOWER												
	ELEC	563	626	1613	3551	5292	5948	6146	6146	5948	4422	1464	813	42,533
	PK	5.2	5.6	6.8	8.3	8.3	8.3	8.3	8.3	8.3	8.3	6.7	5.7	8.3
1	EQ5101	COOLING TOWER												
	WATER	47	48	90	129	166	181	168	177	165	143	84	60	1,459
	PK	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.4
1	EQ5001	CHILLED WATER PUMP C.V.												
	ELEC	11108	10033	11108	10750	11108	10750	11108	11108	10750	11108	10750	11108	130,787
	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
1	EQ5011	CONDENSER WATER PUMP C.V.												
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325	98,024
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

Controls													
ELEC	74	67	74	72	74	72	74	74	72	74	72	74	876
PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2 EQ1001S	2-STG CTV <555 TONS												
ELEC	0	0	0	0	5401	10663	22894	20553	9932	0	0	0	69,443
PK	0.0	0.0	0.0	46.7	55.8	60.2	64.1	63.5	61.5	48.5	0.0	0.0	64.1
2 EQ5100	COOLING TOWER												
ELEC	0	0	0	0	1782	3208	6433	5655	2917	0	0	0	19,995
PK	0.0	0.0	0.0	16.2	16.2	16.2	16.2	16.2	16.2	16.2	0.0	0.0	16.2
2 EQ5100	COOLING TOWER												
WATER	0	0	0	0	31	61	124	113	55	0	0	0	384
PK	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.3
2 EQ5001	CHILLED WATER PUMP C.V.												
ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 EQ5010	CONDENSER WATER PUMP C.V.												
ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 EQ5300	CONTROL PANEL & INTERLOCK												
ELEC	0	0	0	0	110	198	397	349	180	0	0	0	1,234
PK	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	1.0
1 EQ4002	BI CENTRIF. FAN C.V.												
ELEC	13896	12820	14538	15163	18897	19610	23076	22978	18735	16169	14082	14447	204,411
PK	22.6	23.6	29.2	35.8	41.0	46.7	47.1	47.1	41.4	39.8	25.7	23.6	47.1
2 EQ4002	BI CENTRIF. FAN C.V.												
ELEC	12312	11304	13733	14424	16584	16986	18586	18987	16286	15273	13134	12731	180,340
PK	24.0	24.3	26.4	30.9	31.5	33.6	33.6	33.6	32.0	30.9	26.2	24.6	33.6
3 EQ4002	BI CENTRIF. FAN C.V.												
ELEC	28681	26808	32652	35588	45352	49397	54781	54206	44859	39117	31679	30473	473,592
PK	65.4	67.0	81.3	91.9	104.2	118.7	119.4	119.4	106.5	94.8	82.7	67.8	119.4
1 EQ2001	GAS FIRE TUBE HOT WATER												
GAS	1476	1186	529	159	34	0	0	0	17	183	597	1134	5,314
PK	3.8	3.4	1.7	0.6	0.4	0.0	0.0	0.0	0.3	0.7	1.9	2.6	3.8
1 EQ5020	HEAT WATER CIRC. PUMP C.V.												
ELEC	278	251	260	138	50	0	0	0	22	144	254	278	1,674
PK	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4
1 EQ5240	BOILER FORCED DRAFT FAN												
ELEC	1109	1001	1109	1006	861	0	0	0	939	814	1073	1109	9,019
PK	1.5	1.5	1.5	1.5	1.5	0.0	0.0	0.0	1.5	1.5	1.5	1.5	1.5
1 EQ5307	BOILER CONTROLS												
ELEC	223	202	223	202	173	0	0	0	189	164	216	223	1,816
PK	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

Gas Fire Tube Hot Water

	GAS	876	726	375	131	32	0	0	0	16	159	419	724	3,459
	PK	2.4	1.8	1.1	0.6	0.4	0.0	0.0	0.0	0.3	0.6	1.2	1.5	2.4
2	EQ5020	HEAT WATER CIRC. PUMP C.V.												
	ELEC	833	752	677	347	104	0	0	0	67	416	690	833	4,719
	PK	1.1	1.1	1.1	1.1	1.1	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1
2	EQ5240	BOILER FORCED DRAFT FAN												
	ELEC	1109	1001	1109	626	1062	0	0	0	268	781	1073	1109	8,137
	PK	1.5	1.5	1.5	1.5	1.5	0.0	0.0	0.0	1.5	1.5	1.5	1.5	1.5
2	EQ5307	BOILER CONTROLS												
	ELEC	223	202	223	126	214	0	0	0	54	157	216	223	1,638
	PK	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3
3	EQ2001	GAS FIRE TUBE HOT WATER												
	GAS	2126	1668	742	192	28	0	0	0	0	211	799	1584	7,350
	PK	5.9	5.4	2.9	1.4	0.9	0.0	0.0	0.0	0.0	1.4	3.1	4.2	5.9
3	EQ5020	HEAT WATER CIRC. PUMP C.V.												
	ELEC	1665	1504	1182	414	69	0	0	0	0	517	1173	1620	8,144
	PK	2.2	2.2	2.2	2.2	2.2	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.2
3	EQ5240	BOILER FORCED DRAFT FAN												
	ELEC	1665	1504	1665	1611	1526	0	0	0	1343	1553	1611	1665	14,144
	PK	2.2	2.2	2.2	2.2	2.2	0.0	0.0	0.0	2.2	2.2	2.2	2.2	2.2
3	EQ5307	BOILER CONTROLS												
	ELEC	372	336	372	360	341	0	0	0	300	347	360	372	3,160
	PK	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2
MOD CONFIG - BLDG 300 WITHOUT VAV

------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	351,780	626	6,514	137	14
Feb	318,420	626	5,274	127	14
March	360,536	643	2,530	174	8
April	355,974	679	586	220	3
May	387,033	696	9	317	0
June	391,920	717	0	377	0
July	409,254	726	0	412	0
Aug	410,673	720	0	399	0
Sept	376,847	698	0	314	0
Oct	373,457	680	782	241	4
Nov	345,639	645	2,834	167	9
Dec	352,402	628	5,204	147	11
Total	4,433,935	726	23,732	3,032	14

Building Energy Consumption = 287,740 (Btu/Sq Ft/Year)
Source Energy Consumption = 288,947 (Btu/Sq Ft/Year)

Floor Area = 60,840 (Sq Ft)

2 OF 4

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2
MOD CONFIG - BLDG 300 WITHOUT VAV

---------------------------------- E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N ----------------------------------

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
		Monthly Consumption												
0	LIGHTS													
	ELEC	16830	15222	18120	16079	17475	17369	16185	18120	16079	17475	16079	16185	201,220
	PK	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3
1	MISC LD													
	ELEC	129522	117009	130910	125119	130216	126508	128827	130910	125119	130215	125119	128827	1,528,301
	PK	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1070L		WTR-CLD RECIP >30 TONS											
	ELEC	25085	23281	31385	32200	30020	26957	27345	27614	31344	34134	29293	26908	345,568
	PK	56.9	58.9	67.7	67.8	67.9	70.3	54.0	74.8	74.7	72.0	65.7	60.6	74.8
1	EQ5101		COOLING TOWER											
	ELEC	3503	3266	4242	4816	5846	5948	6146	6146	5948	5448	3973	3732	59,014
	PK	7.3	7.4	7.6	8.3	8.3	8.3	8.3	8.3	8.3	8.3	7.6	7.5	8.3
1	EQ5101		COOLING TOWER											
	WATER	137	127	174	179	165	144	139	141	164	188	162	147	1,866
	PK	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.3	0.4
1	EQ5001		CHILLED WATER PUMP C.V.											
	ELEC	11108	10033	11108	10750	11108	10750	11108	11108	10750	11108	10750	11108	130,787
	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
1	EQ5011		CONDENSER WATER PUMP C.V.											
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325	98,024
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2
MOD CONFIG - BLDG 300 WITHOUT VAV
CONTROL

	ELEC	74	67	74	72	74	72	74	74	72	74	72	74	876
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	EQ1001S	2-STG CTV <555 TONS												
	ELEC	0	0	0	7188	25898	40020	48586	46116	26645	9243	919	0	204,615
	PK	0.0	0.0	50.5	62.4	75.9	89.1	94.6	90.8	77.2	63.7	49.8	0.0	94.6
2	EQ5100	COOLING TOWER												
	ELEC	0	0	0	1863	7454	10565	12055	11683	7356	2852	103	0	53,930
	PK	0.0	0.0	6.3	16.2	16.2	16.2	16.2	16.2	16.2	16.2	6.1	0.0	16.2
2	EQ5100	COOLING TOWER												
	WATER	0	0	0	41	152	233	273	258	150	54	5	0	1,166
	PK	0.0	0.0	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.3	0.0	0.5
2	EQ5001	CHILLED WATER PUMP C.V.												
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	EQ5010	CONDENSER WATER PUMP C.V.												
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	EQ5300	CONTROL PANEL & INTERLOCK												
	ELEC	0	0	0	140	460	652	744	721	454	176	20	0	3,367
	PK	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	1.0
1	EQ4002	BI CENTRIF. FAN C.V.												
	ELEC	36077	32585	36077	34913	36077	34913	36077	36077	34913	36077	34913	36077	424,773
	PK	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5
2	EQ4002	BI CENTRIF. FAN C.V.												
	ELEC	24976	22559	24976	24170	24976	24170	24976	24976	24170	24976	24170	24976	294,073
	PK	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6
3	EQ4002	BI CENTRIF. FAN C.V.												
	ELEC	88804	80210	88804	85939	88804	85939	88804	88804	85939	88804	85939	88804	1,045,593
	PK	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4
1	EQ2001	GAS FIRE TUBE HOT WATER												
	GAS	1886	1540	835	256	9	0	0	0	0	306	914	1561	7,307
	PK	3.7	3.6	2.3	1.2	0.3	0.0	0.0	0.0	0.0	1.3	2.5	3.1	3.7
1	EQ5020	HEAT WATER CIRC. PUMP C.V.												
	ELEC	278	251	235	123	12	0	0	0	0	127	246	278	1,548
	PK	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4
1	EQ5240	BOILER FORCED DRAFT FAN												
	ELEC	1109	1001	1109	894	240	0	0	0	0	554	1073	1109	7,088
	PK	1.5	1.5	1.5	1.5	1.5	0.0	0.0	0.0	0.0	1.5	1.5	1.5	1.5
1	EQ5307	BOILER CONTROLS												
	ELEC	223	202	223	180	48	0	0	0	0	112	216	223	1,427
	PK	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2
MOD CONFIG - BLDG 300 WITHOUT VAV

GAS FIRE TUBE WATER HEATER

	GAS	1418	1179	624	180	0	0	0	0	0	217	690	1192	5,500
	PK	2.9	2.9	1.8	0.9	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.5	2.9
2	EQ5020		HEAT WATER CIRC. PUMP C.V.											
	ELEC	833	752	660	313	0	0	0	0	0	333	694	833	4,418
	PK	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1
2	EQ5240		BOILER FORCED DRAFT FAN											
	ELEC	1109	1001	1109	894	0	0	0	0	0	948	1073	1109	7,241
	PK	1.5	1.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	1.5	1.5	1.5	1.5
2	EQ5307		BOILER CONTROLS											
	ELEC	223	202	223	180	0	0	0	0	0	191	216	223	1,458
	PK	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3
3	EQ2001		GAS FIRE TUBE HOT WATER											
	GAS	3210	2555	1071	150	0	0	0	0	0	259	1229	2451	10,925
	PK	7.5	7.2	3.9	1.6	0.0	0.0	0.0	0.0	0.0	1.7	4.5	5.9	7.5
3	EQ5020		HEAT WATER CIRC. PUMP C.V.											
	ELEC	1665	1419	920	278	0	0	0	0	0	416	962	1576	7,235
	PK	2.2	2.2	2.2	2.2	0.0	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.2
3	EQ5240		BOILER FORCED DRAFT FAN											
	ELEC	1665	1504	1665	1477	0	0	0	0	0	1526	1432	1665	10,935
	PK	2.2	2.2	2.2	2.2	0.0	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.2
3	EQ5307		BOILER CONTROLS											
	ELEC	372	336	372	330	0	0	0	0	0	341	320	372	2,443
	PK	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3
MOD CONFIG - BLDG 300 MINUS NEW CHIL PLT

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	243,097	532	4,478	51	12
Feb	224,201	535	3,581	53	11
March	266,268	569	1,645	97	6
April	274,584	625	482	134	3
May	315,753	663	95	201	2
June	323,682	688	0	245	0
July	347,964	697	0	295	0
Aug	351,172	695	0	292	0
Sept	315,554	671	33	224	1
Oct	293,754	633	552	149	2
Nov	253,297	566	1,814	91	6
Dec	250,829	537	3,442	66	8
Total	3,460,157	697	16,123	1,896	12

Building Energy Consumption = 220,607 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 221,427 (Btu/Sq Ft/Year)

OLD MOD. CONFIG. = NEW MOD. CONFIG. w/o Efficient Lighting.

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	239,240	535	4,413	48	12
Feb	218,464	540	3,512	48	11
March	257,005	582	1,615	92	6
April	258,995	638	471	132	3
May	298,097	668	96	201	2
June	304,983	690	0	247	0
July	331,334	701	0	298	0
Aug	333,977	699	0	295	0
Sept	295,764	672	34	226	1
Oct	276,111	635	544	147	2
Nov	244,796	578	1,785	86	6
Dec	243,174	547	3,379	60	8
Total	3,301,940	701	15,848	1,879	12

Building Energy Consumption = 211,279 (Btu/Sq Ft/Year)   Floor Area = 60,840 (Sq Ft)
Source Energy Consumption = 212,085 (Btu/Sq Ft/Year)

Σ Monthly kW = 7,485

JOB ______

SHEET NO. ______ OF ______

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY ______ DATE ______

CHECKED BY ______ DATE ______

SCALE ______

P-300 ECO #6 THERMAL STORAGE

REBATE CALCULATION:

DESIGN LOAD:	EAST WING	39.4T	simultaneous at 1600hr on July 7
	WEST WING	52.0T	
	SOUTH BLDG	129.0T	
		320.4 TON	

$$\text{COMPRESSOR LOAD} = 0.9\,\frac{kW}{TON} \times 320.4\,T = 288.4\ kW.$$

$$\text{REBATE} = \$190 \times 288.4 = \$54,788$$

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 21140 – ENERGY EFFICIENT LAMPS & BALLASTS FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/10/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$281		
B. SIOH COST	(5.5% of 1A) =	$15		
C. DESIGN COST	(6.0% of 1A) =	$17		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$313		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	————>		$313

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	1	$7	15.23	$112	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		1	7.3		————>	$112

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $35
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $515

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $515

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $37

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.47

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$42
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$627
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.00
7 SIMPLE PAYBACK (SPB)	(1F/4) =	7.38

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 21140 – DESTRATIFICATION FANS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/10/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$4,077	
B. SIOH COST	(5.5% of 1A) =		$224	
C. DESIGN COST	(6.0% of 1A) =		$245	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$4,546	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$4,546

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$18.37	13	$234	15.23	$3,569	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		13	234.3		————>	$3,569

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (MAINTENANCE SAVINGS)	=		$100	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$1,468	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$1,468
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$1,178	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	1.04	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$334
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$5,037
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.11
7 SIMPLE PAYBACK (SPB)	(1F/4) =	13.60

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) ECO'S – BLDG. 21140	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER / WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	12	2.19	26.28	0.09	27.60	29.15		$55.43
	ENERGY EFFICIENT BALLASTS	EA	6	14.06	84.36	0.85	27.60	140.93		$225.29
	TOTAL									$280.71
2	DESTRATIFICATION FANS									
	HEAVY DUTY CEILING FANS	EA	4	218.00	872	5.00	27.60	552.00		$1,424.00
	CEILING FAN SPEED CONTROLS	EA	4	24.55	98.2	0.50	27.60	55.20		$153.40
	ELECT. CONDUIT, WIRING, & CNTRL WIRING	EA	1	2500	2500	Includes Labor, Material, & Equip.				$2,500.00
	TOTAL									$4,077.40
	TOTAL THIS SHEET									$8,716.22

Material Source: Lightbulb Supply Co., Denver, CO, and McMaster-Carr Supply Co., Chicago, IL: Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

JOB
CALCULATED BY: A.S. DATE: 6/22/92
CHECKED BY: [illegible] DATE: 6/24/92
PAGE: ____ OF ____

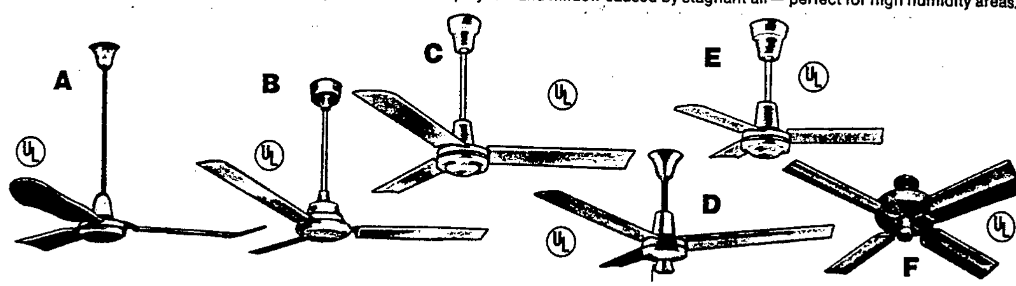
LIGHTING
ENERGY SAVINGS CALCULATIONS

BLDG.	# HRS/YR	EXISTING					PROPOSED					DEMAND REDUCTION (KW)	ENERGY SAVINGS (KWH)	ANNUAL ELECTRICAL COST SAVINGS	CONSTRUCTION COST ESTIMATE
		# FIXTURES	TYPE	FIXTURE (KW)	TOTAL (KW)	KWH/YR	# FIXTURES	TYPE	FIXTURE (KW)	TOTAL (KW)	KWH/YR				
21140	2210	6	FL	0.096	0.576	1273.0	6	FL	0.071	0.426	941.5	0.150	331.5	$42.43	
						1273.0					941.5	0.150	331.5	$42.43	~~$250.65~~ 280.71

KEY:
- FL = FLUORESCENT
- IN = INCANDESCENT
- MV = MERCURY VAPOR
- MH = METAL HALIDE

CEILING FANS

Whatever the season, there's a reason to use a ceiling fan. Winter—Fans recover wasted heat by pushing heated air down from the ceiling. The elimination of cold spots increases employee productivity and comfort. **Summer**—Fans recirculate non air-conditioned air to create a cooling breeze. They help eliminate mold and mildew caused by stagnant air— perfect for high humidity areas.



A 56" CEILING FAN WITH STEEL BLADES—Fan features three steel blades with steel support arms to insure correct blade angle for maximum efficiency. Blades have a white enamel finish. Ideal for commercial and industrial buildings.

115 V, 60 Hz motor draws 0.70 amps at 260 rpm. **Maximum circulation is 20,513 cfm at 20 ft.**

Fan has 56" diameter blades and a 30" downrod. **Mount fan at least 10 ft. above the floor. Mounting bracket is included. UL Listed.**

No. 2223K11 .... NET EACH $97.62

B 56" SPRAY AND DUST RESISTANT CEILING FAN—This fan can be used safely in wet locations—completely impervious to humidity, water, dust, and airborne debris. Ideal for steel mills, foundries, factories, warehouses, food processing plants, poultry barns, and auto repair centers where fans must be cleaned with a hose. **Fan is preassembled—just hang, mount blades, and wire.**

120 V, 50/60 Hz motor draws 1.0 amps at 265 rpm. **Maximum circulation is 25,500 cfm at 20 ft.** The motor is totally enclosed with thermal overload protection. Pre-wired with 18" long #18/SJT cord and molded plug. Fan has 56" dia. aluminum blades with white epoxy finish, sealed bearings, and 12" downrod. **Mount fan at least 10 ft. above floor.** For maximum heat utilization, locate fan near heat-producing equipment to keep warmth at floor level. **UL Listed.**

No. 1931K66 .... NET EACH $156.25

C [illegible] industrial buildings where there's a lot of area to cover.

120 V, 60 Hz motor draws 1.4 amps at 315 rpm. **Maximum circulation is 46,000 cfm at 20 ft.** Motor is totally enclosed and features thermal-overload protection.

Fan has 60" dia. aluminum blades with white epoxy enamel finish, permanently sealed and greased bearings, and 24" downrod. **Mount fan at least 10 ft. above floor.** Safety cable is included. **UL Listed.**

No. 15845K5 .... NET EACH $175.17

D 56" ALL SEASON CEILING FANS— Select standard 1-speed models or 3-speed fan with pull chain. Totally-enclosed, thermal overload protected motors operate on 50/60 Hz. 56" dia. aluminum fan blades have a corrosion-resistant white epoxy enamel finish.

Fans have a 24" downrod; 3-speed fan has an extra 8" rod. **3-speed fan can be suspended minimum of 7 ft. from the floor. Mount other fans at least 10 ft. from floor.** Safety cable is included. **UL Listed.**

Volts	Amps	Max. RPM	Max. CFM at 20 ft.	No.	NET EACH
1-SPEED FANS					
120	0.90	265	23,000	1917K21	$137.37
277	0.44	260	26,000	1917K25	129.79
3-SPEED FAN WITH PULL CHAIN					
120	1.00	265	25,500	1917K23	135.55

E 36" AND 48" CEILING FANS—Economical, reliable fans are great for small areas. Capacitor-style, totally enclosed motors operate on 120V, 50/60 Hz. Aluminum blades are mounted on steel blade holders for vibration-free service. Corrosion-resistant, white epoxy enamel finish. **UL Listed.**

Blade Dia.	Amps	Max. RPM	Max. CFM	No.	NET EACH
36"	0.47	395	8,610	2056K82	$87.64
48"	0.60	315	18,600	2056K84	90.43

F 3-SPEED ELECTRICALLY REVERSIBLE CEILING FANS—Ideal for rooms with low ceilings. The 42" model has reversible white/pickled oak wood blades with white motor and irons. The 52" model has reversible hardwood blades that are walnut on one side; oak on the other. Both have a brown cast-iron housing. Reversible motors have precision-ground ball bearings and oil bath lubrication for long life. A pull chain controls on/off and three speeds. Motors operate on 120 V, 60 Hz. Mounting kit for 8-ft. ceilings is included. **UL Listed.**

Blade Dia.	Max. Amps	RPM Range	Max. CFM	No.	NET EACH
42"	0.6	80-240	5000	1913K6	$196.43
52"	1.0	50-190	7600	1913K3	272.73

[illegible]

Speed Control

[illegible] to double-gang switch box; has oversize faceplate.

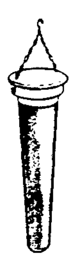
Volts	Max. Amps	No.	NET EACH
115	2.5	2042K74	$15.79
115	6.0	2042K75	19.64
115	10.0	2042K76	57.00
277	3.0	2042K78	22.62
277	8.0	2042K79	45.57

CEILING FAN INSTALLATION KIT — Contains two 3½" threaded steel rods, two U-shaped metal feet, one electrical box, one hammer bar, plus spacers and nuts.

Kits are UL Listed for fans/fixtures up to 35 pounds mounted on box ears, fans with narrow brackets on bolts, and fixtures up to 100 pounds on bolts.

No. 2042K77 .... NET EACH $18.31

Heat Recovery Ceiling Fans



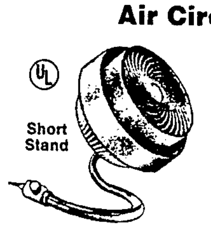
Save 15%-30% in heating costs annually! Heated air rises and accumulates near the ceiling. . .these fans draw in this warm air, direct it downward through a duct, and discharge it at the floor level where it mixes with the cooler air. Fans feature a thermostat that can be set between 60° F and 105° F (they are pre-set at 75° F). Fans shut off when temperature at ceiling drops below setting.

The shaded pole motor operates on 120V, 60 Hz. 6-ft. cord and 3-prong plug are included. **Motor and cord are UL Listed.**

Suspend fans from ceiling, a column, or an overhead structure. One 45-ft. flexible duct is included. Duct, housing, and fan blade are flame retardant.

Effective Area Square Feet	Air Flow CFM	No.	NET EACH
2500	400	1918K13	$129.18
2000	250	1918K14	111.36
Extra Duct—45-foot length		1918K51	31.50

Vortex Action Portable Air Circulation Fans



Short Stand

Get all the air movement benefits of a ceiling fan in these floor fans, plus an added advantage—they're portable! Fans are fully assembled and feature vortex action which gently and quietly moves air. Great for high velocity air movement in the summer and soothing, low velocity destratification in the winter.

Motors operate on 115V, 85 watts. They feature an infinitely variable speed control from 200 to 1500 rpm. Fans maintain stream of air for up to 75 feet to provide total room air circulation.

These polypropylene fans have a steel strut base and a graystone color. **Fans meet or exceed UL and OSHA standards.**

Description	Ht. × Wd. × Lg.	No.	NET EACH
Short Stand	19.5" × 15.25" × 15.25"	1946K89	$111.69
Long Stand	23.0" × 18.50" × 18.50"	1946K91	132.85

McMASTER-CARR

FAN BLADE

Universal Re

Replace any style of propeller—in virtually a applications. Great for roof-top unit heaters, cor densing units, walk-in refrigeration units, plus pec estal and ventilating fans.

The propellers have a steel center (known as

RATED AT 1550 RPM

Blade Dia.	Hp	Pitch	CFM at 0" SP	No.	NET EAC
THREE-BLADE PROPELLERS—FREE AIR STYLE					
10"	0.03	23°	590	2090K119	$8.6
12"	0.05	23°	1040	2090K129	8.9
14"	0.03	23°	1080	2090K139	10.0
16"	0.05	23°	1780	2090K149	12.3
18"	0.11	23°	2330	2090K159	14.1
20"	0.25	23°	3130	2090K169	16.5
24"	0.33	18°	4530	2090K189	22.2
FOUR-BLADE PROPELLERS—FREE AIR STYLE					
10"	0.04	23°	600	2090K199	$8.8
12"	0.06	23°	1070	2090K219	9.4
18"	0.12	23°	2560	2090K249	18.2
20"	0.28	23°	3440	2090K259	19.2
24"	0.36	18°	5030	2090K279	24.2
FOUR-BLADE PROPELLERS—CONDENSER STYL					
14"	0.19	23°	920	2090K329•	$11.3

• Rated at 1625 RPM at 0.30" SP.

Galvanized Steel ar Semi-Stainless Steel Pro

Corrosion-resistant blades are ideal for ai units, roof-top ventilators, plus more. Semi-stair pellers have 304 stainless steel blades and rivets plated steel hub plate. Blade pitch is 27°. Adapt pr bore size by using the appropriate bushing sold

Blade Dia.	RPM	CFM at 0" SP	BHP at 0" SP	CFM at 0.3" SP	BHP at 0.3" SP	M R
24"	1140	6,790	0.62	5,520	0.73	1
26"	1140	9,020	1.10	7,800	1.22	1
28"	1000	9,900	1.07	8,310	1.21	1
30"	1000	11,070	1.27	9,350	1.53	1
36"	840	16,700	2.00	14,160	2.27	
42"	710	21,920	2.83	18,060	3.07	
48"	500	23,750	1.86	16,900	2.18	

SPLIT-TAPERED ZINC-PLA

Bore	No.	NET EACH	Bore	No.
½"	19055K101	$5.88	⅞"	19055
⅝"	19055K102	5.88	1"	19055
¾"	19055K103	5.88	1⅛"	19055

Cast Aluminum Prop

High-grade aluminum alloy propellers are ca that blades can't fly apart, even in around-the- pellers are precision balanced for smooth-runnir lent for use on all kinds of fans.

All propellers run clockwise facing the shaft er have two set screws. Heavy-duty models have st

Table below indicates expected performance

Other bore sizes available for heavy-duty mo 1½" bore. Specify 1910K999, bore size, and bla

Blade Dia.	1725 RPM Hp	1725 RPM CFM	1140 RP Hp	C
THREE-BLADE DISH STYLE PROPELLERS				
12"	1/25	1,255	1/40	
14"	1/20	1,800	1/30	
15"	1/10	2,800	1/20	
16"	⅛	3,100	1/10	
18"	⅙	3,900	⅛	
20"	¼	4,840	⅙	
24"	½	8,165	¼	
30"	1	14,500	½	1
36"	3	28,000	1½	1
TWO-BLADE MEDIUM-DUTY PROPELLERS				
18"	⅛	2,800	⅛	
20"	⅙	3,900	⅛	
24"	¼	4,850	⅙	
30"	½	9,500	¼	
36"	1	14,100	½	1

Blade Dia.	1750 RPM Hp	1750 RPM CFM	H
TWO-BLADE HEAVY-DUTY PROPELLERS			
36"	1½	18,000	1
42"	3	28,000	2
48"	5	33,500	3
FOUR-BLADE HEAVY-DUTY PROPELLERS			
36"	3	21,000	1
42"	5	31,000	3
48"	7½	41,000	5

JOB	WSMR ESOS STUDY #1110-000
SHEET NO.	1 OF 7
CALCULATED BY	TF DATE 3/18/92
CHECKED BY	DATE
SCALE	

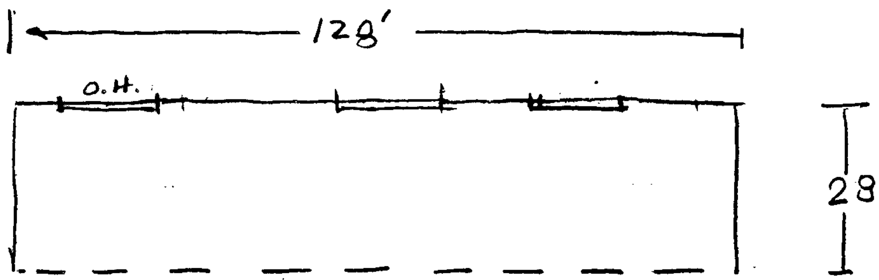
E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

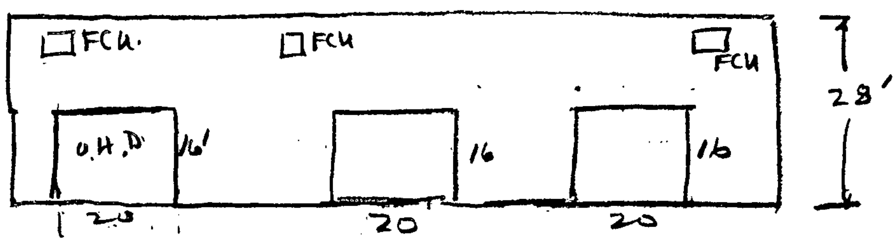
BLDG P21140 TEMP. TEST FACILITY

ECO: INSTALL FANS TO DESTRATIFY A HIGH BAY ENTRANCE AREA.

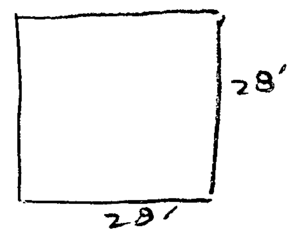
CURRENT SITUATION: Temperature stratification exists. Fancoil units heat the space, but hang high in the bay (22' above the floor).



FLOOR PLAN



NORTH ELEVATION



EAST & WEST ELEVATIONS

ROOF AREA = 128 x 28 = 3,584

O.H. DOOR AREA = 3 x 20 x 16 = 960 SF

EXT. WALL AREA = 2 x 28 x 28 + 128 x 28 − 960 = 4,192 SF.

ROOF R VALUE = 25 ; U = 0.04 } From TRACE 600 BASELINE MODEL.

WALL R VALUE = 2.96 ; U = 0.336 }

O.H. DOOR (2½" STEEL) U = 0.60 (ASHRAE F22.12, TABLE 6)

JOB

SHEET NO. 2 OF 7

E M C ENGINEERS, INC.

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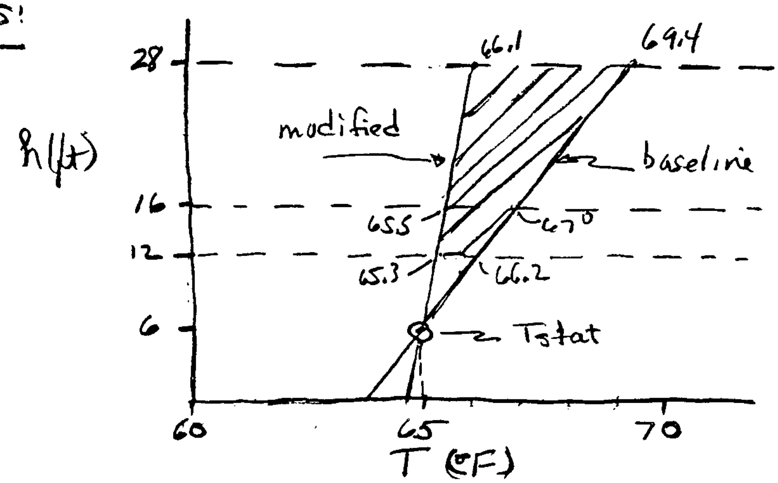
TEMPERATURE PROFILES:

Reduction in heat conduction occurs above 12' height



METHOD.

CALCULATE HEAT CONDUCTION LOSSES FOR THE BASELINE & MODIFIED TEMPERATURE PROFILES FOR ALL SURFACES ABOVE 12 FT.

$$\dot{q}\,(\text{BTU/yr})\Big|_{\text{baseline}} = UA \times \#\ \text{baseline heating degree hours}$$

$$\dot{q}\,(\text{BTU/yr})\Big|_{\text{modified}} = UA \times \#\ \text{modified heating degree hours.}$$

CALCULATE the temperature base on which heating degree hours will be calculated:

$$T_{base}\Big|_{baseline} = [A_w \times \text{Ave wall Temp} + A_{roof} \times \text{roof temp} + A_{doors} \times \text{Ave door temp}] / (A_w + A_r + A_D)$$

$A_w = (2 \times 28 \times 16) + (128 \times 16) - (3 \times 20 \times 4) = 2704\ SF.$

$A_D = 3 \times 20 \times 4 = 240\ SF.$

$A_r = 128 \times 28 = 3{,}584\ SF.$

TOTAL AREA = 6,528 SF

JOB

SHEET NO. 3 OF 7

E M C ENGINEERS, INC.

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CALCULATED BY DATE

CHECKED BY DATE

SCALE

$$T_{base}\Big|_{baseline} = \frac{2704 \times \left(\frac{66.2 + 69.4}{2}\right) + 3584 \times 69.4 + 240 \times \left(\frac{66.2 + 67}{2}\right)}{6528}$$

$$= 68.6\,°F$$

$$T_{base}\Big|_{modified} = \frac{2704 \times \left(\frac{65.3 + 66.1}{2}\right) + 3584 \times 66.1 + 240 \times \left(\frac{65.3 + 65.5}{2}\right)}{6528}$$

$$= 66.0\,°F.$$

From TM5-785 FOR FT. BLISS, CALCULATE ANNUAL HEATING DEGREE HOURS FOR THESE 2 BASE TEMPS;

(See next page)

Baseline # HD hrs = 74,703

Modified # HD hrs = 65,040.

calculate $UA = U_r A_r + U_W A_W + U_D A_D$

$= .04 \times 3584 + .336 \times 2704 + .60 \times 240$

$= 1196$ BTU/°F-hr

$\dot{q}\Big|_{baseline} = 1196 \times 74,703 = 96.8$ MBTU/yr

$\dot{q}\Big|_{modified} = 1196 \times 65,040 = 84.3$ MBTU/yr

Electrical source energy savings $= \frac{96.8 - 84.3}{.98} = 12.8$ MBTU/yr.

$= 12.8$ MBtu/.003413 MBtu/kwH

$= 3,737$ kWh/yr.

E M C ENGINEERS, INC.	JOB WSMR ESOS STUDY #1110-000
Denver • Colorado Springs • Atlanta • West Germany	SHEET NO. 4 OF 7
	CALCULATED BY TR DATE 3/18/92
	CHECKED BY DATE
	SCALE

TM 5-785 PG. 3-372 & 3-373

TOTAL OBSERVATION (HRS)

Temp Range	OCT	NOV	DEC	JAN	FEB	MAR	t_{BIN} (hrs)	$\tilde{T}_{bin}$	BIN NO.
65/69	119	68	19	21	39	88	354	67.5	14
60/64	122	88	54	56	67	109	496	62.5	13
55/59	110	99	79	77	85	117	567	57.5	12
50/54	71	107	98	104	101	104	585	52.5	11
45/49	35	109	114	113	101	94	566	47.5	10
40/44	13	95	114	113	87	63	485	42.5	9
35/39	1	64	109	103	73	43	393	37.5	8
30/34		30	90	75	50	20	265	32.5	7
25/29		13	43	43	27	9	135	27.5	6
20/24		2	14	21	12	1	50	22.5	5
15/19			3	8	6		17	17.5	4
10/14			1	4	1		6	12.5	3
5/9				1			1	7.5	2
0/4				1			1	2.5	1

heating degree hours baseline $= \sum_{i=1}^{14} (68.6 - \tilde{T}_{bin_i}) \times t_i = 74,703$ deg hrs.

heating degree hours modified $= \sum_{i=1}^{13} (66.0 - \tilde{T}_{bin_i}) \times t_i = 65,040$ deg hrs.

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 21140

5 OF 7

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	ROOM 1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM 3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
1	ROOM 1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM 3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
2	ROOM 2	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Zone	2 Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
System	3 Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Building		0.047	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	170.8	34.80

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 21140

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
✓ 1	ROOM 1	1	1	3,584	3,584	0	184	0	0	3,584	0	0	5,125
Zone	1 Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM 3	1	1	8,063	8,063	0	280	0	0	8,063	0	0	7,165
Zone	3 Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	1 Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
1	ROOM 1	1	1	3,584	3,584	0	184	0	0	3,584	0	0	5,125
Zone	1 Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM 3	1	1	8,063	8,063	0	280	0	0	8,063	0	0	7,165
Zone	3 Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	2 Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
2	ROOM 2	1	1	336	336	592	0	0	0	0	0	0	0
Zone	2 Total/Ave.				336	592	0	0	0	0	0	0	0
System	3 Total/Ave.				336	592	0	0	0	0	0	0	0
Building					23,630	592	928	0	0	23,294	0	0	24[illegible]

FORT BLISS/BIGGS AAF TEXAS

LAT 31 51N LONG 106 23W ELEV 3947 FT

MEAN FREQUENCY OF OCCURRENCE OF DRY BULB TEMPERATURE (DEGREES F) WITH MEAN COINCIDENT WET BULB TEMPERATURE (DEGREES F) FOR EACH DRY BULB TEMPERATURE RANGE

Temperature Range	MAY Obsn Hour Gp 01 to 08	MAY 09 to 16	MAY 17 to 24	MAY Total Obsn	MAY MCWB	JUNE Obsn Hour Gp 01 to 08	JUNE 09 to 16	JUNE 17 to 24	JUNE Total Obsn	JUNE MCWB	JULY Obsn Hour Gp 01 to 08	JULY 09 to 16	JULY 17 to 24	JULY Total Obsn	JULY MCWB
105/109		0		0	63		1	0	1	64		0	0	0	68
100/104		1	0	1	62		12	4	16	64		9	3	12	66
95/99		4	1	5	61		40	19	59	63		39	16	55	66
90/94		26	11	37	59	1	67	44	112	61	0	66	40	106	65
85/89	1	52	29	82	57	9	60	54	123	60	5	65	54	124	65
80/84	3	62	47	112	55	29	38	51	118	59	32	40	59	131	64
75/79	18	49	55	122	53	66	16	40	122	58	84	18	46	148	63
70/74	45	30	46	121	52	68	5	18	91	57	91	7	24	122	63
65/69	60	15	29	104	50	43	1	7	51	54	33	3	6	42	63
60/64	59	8	18	85	48	20	0	2	22	50	3	0	1	4	60
55/59	37	2	8	47	45	4		0	4	46					
50/54	17	0	2	19	41	1			1	40					
45/49	6		1	7	37										
40/44	2		0	2	35										
35/39	0			0	29										
30/34															

Temperature Range	AUGUST Obsn Hour Gp 01 to 08	AUGUST 09 to 16	AUGUST 17 to 24	AUGUST Total Obsn	AUGUST MCWB	SEPTEMBER Obsn Hour Gp 01 to 08	SEPTEMBER 09 to 16	SEPTEMBER 17 to 24	SEPTEMBER Total Obsn	SEPTEMBER MCWB	OCTOBER Obsn Hour Gp 01 to 08	OCTOBER 09 to 16	OCTOBER 17 to 24	OCTOBER Total Obsn	OCTOBER MCWB
105/109															
100/104		1	0	1	69										
95/99		25	8	33	66		6	1	7	64					
90/94		68	32	100	65		38	9	47	63		1	0	1	62
85/89	1	73	53	127	65	0	57	26	83	62		16	2	18	60
80/84	16	51	68	135	64	3	59	48	110	61		47	13	60	58
75/79	73	24	59	156	63	19	45	64	128	60	2	54	30	86	56
70/74	108	5	22	135	62	68	24	54	146	59	9	53	45	107	55
65/69	48	1	5	54	61	83	9	28	120	57	27	38	54	119	53
60/64	3	0	0	3	60	50	2	7	59	54	47	24	51	122	51
55/59						13	1	2	16	51	66	10	34	110	48
50/54						3	0	0	3	46	56	3	12	71	44
45/49						0			0	43	29	1	5	35	40
40/44											11	1	1	13	37
35/39											1			1	33
30/34											0			0	28

FORT BLISS/BIGGS AAF TEXAS

Temperature Range	NOVEMBER Obsn Hour Gp 01 to 08	09 to 16	17 to 24	Total Obsn	MCWB	DECEMBER Obsn Hour Gp 01 to 08	09 to 16	17 to 24	Total Obsn	MCWB	JANUARY Obsn Hour Gp 01 to 08	09 to 16	17 to 24	Total Obsn	MCWB
105/109															
100/104															
95/99															
90/94															
85/89															
80/84		1		1	56										
75/79		6	1	7	54		0		0	52		0		0	59
70/74	0	33	7	40	51		6	1	7	51		3	1	4	51
65/69	2	44	22	68	49	0	14	5	19	48		15	6	21	48
60/64	8	45	35	88	47	3	35	16	54	46	2	34	20	56	46
55/59	20	38	41	99	45	7	44	28	79	44	7	41	29	77	43
50/54	31	31	45	107	42	14	46	38	98	41	16	48	40	104	41
45/49	45	23	41	109	39	23	42	49	114	38	28	41	44	113	38
40/44	53	13	29	95	36	38	29	47	114	35	38	31	44	113	35
35/39	45	5	14	64	32	54	18	37	109	32	48	20	35	103	31
30/34	24	2	4	30	28	58	10	22	90	28	49	8	18	75	28
25/29	11	0	2	13	24	34	2	7	43	24	34	3	6	43	24
20/24	2	0	0	2	20	12	1	1	14	20	17	1	3	21	19
15/19	0			0	16	3	0	0	3	16	5	1	2	8	14
10/14						1			1	11	3	1	0	4	10
5/9						0			0	6	0	0	1	1	6
0/4											1	0	0	1	0
-5/-1											0	0		0	-4
-10/-6											0			0	-8

Temperature Range	FEBRUARY Obsn Hour Gp 01 to 08	09 to 16	17 to 24	Total Obsn	MCWB	MARCH Obsn Hour Gp 01 to 08	09 to 16	17 to 24	Total Obsn	MCWB
105/109										
100/104										
95/99										
90/94										
85/89										
80/84		0		0	55		4	1	5	53
75/79		3	1	4	53		20	8	28	51
70/74		13	5	18	49	1	39	23	63	49
65/69	0	25	14	39	47	6	42	40	88	47
60/64	4	35	28	67	45	21	43	45	109	45
55/59	14	38	33	85	43	36	40	41	117	43
50/54	21	40	40	101	40	41	27	36	104	40
45/49	35	28	38	101	37	49	19	26	94	38
40/44	39	19	29	87	34	38	9	16	63	34
35/39	42	12	19	73	31	30	4	9	43	31
30/34	35	5	10	50	27	17	1	2	20	27
25/29	19	3	5	27	23	7	1	1	9	23
20/24	9	1	2	12	20	1		0	1	21
15/19	4	1	1	6	16	0		0	0	15
10/14	1	0	0	1	12	0			0	13
5/9	0			0	9					
0/4										
-5/-1										
-10/-6										

Temperature Range	APRIL Obsn Hour Gp 01 to 08	09 to 16	17 to 24	Total Obsn	MCWB	ANNUAL TOTAL Obsn Hour Gp 01 to 08	09 to 16	17 to 24	Total Obsn	MCWB
105/109							1	0	1	65
100/104							23	7	30	65
95/99		0	0	0	59		114	45	159	65
90/94		1	0	1	57	1	267	136	404	63
85/89	0	9	4	13	55	16	332	222	570	62
80/84		33	15	48	53	83	335	302	720	60
75/79	1	55	39	95	51	263	290	343	896	58
70/74	10	53	50	113	49	400	271	296	967	56
65/69	32	39	48	119	48	334	246	264	844	52
60/64	44	27	38	109	46	264	253	261	778	48
55/59	57	14	26	97	43	261	228	242	731	44
50/54	46	6	12	64	41	246	201	225	672	41
45/49	33	2	6	41	38	248	156	210	614	38
40/44	17	1	1	15	34	232	103	167	502	35
35/39	3	0		3	31	223	59	114	396	31
30/34	0			0	27	183	26	56	265	28
25/29						105	9	21	135	24
20/24						41	3	6	50	20
15/19						12	2	3	17	15
10/14						5	1	0	6	11
5/9						0	0	1	1	7
0/4						1	0	0	1	0
-5/-1						0	0		0	-4
-10/-6						0			0	-8

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STATE / Station	Lat °	Lat ′	Long °	Long ′	Elev (feet)	Winter Dry Bulb 99% (°F)	Winter Dry Bulb 97.5% (°F)	Pvlg Wind (dir)	Mean Speed (knots)	Degree Days Heating (annual)	Summer 1% Dry Bulb (°F)	1% MCWB (°F)	2.5% Dry Bulb (°F)	2.5% MCWB (°F)	Mean Daily Range (°F)	Pvlg Wind (dir)	5% Dry Bulb (°F)	5% MCWB (°F)	Wet Bulb 1% (°F)	Wet Bulb 2.5% (°F)	Wet Bulb 5% (°F)	Dry Bulb ≥ 93°F (hrs)	Dry Bulb ≥ 80°F (hrs)	Wet Bulb ≥ 73°F (hrs)	Wet Bulb ≥ 67°F (hrs)
TEXAS (CONT)	N		W																						
Beaumont Army Hospital	31	49	106	28	4185	20	24	N	7	2678	100	64	98	64	25	S	96	64	69	68	68	370	1917	0	376
Beeville/Chase Field NAS	28	22	97	40	190	30	33	N	9	1189	99	78	97	77	21	SSE	95	77	82	81	79	301	2144	2776	3786
Bergstrom AFB/Austin	30	12	97	40	541	24	28	N	10	1712	99	74	97	75	22	S	96	75	79	78	77	363	1966	1844	3384
Brooke Army Medical Center	29	28	98	27	785	25	30	N	8	1570	99	72	97	73	22	SSE	96	73	77	76	76	397	2049	1699	3426
Brooks AFB	29	21	98	27	598	28	32	N	10	1272	100	74	98	74	22	SSE	97	74	78	77	77	460	2189	2185	3551
Brownsville IAP	25	54	97	26	19	35	39	NNW	13	650	94	77	93	77	16	SE	92	77	80	79	79	103	2456	3391	4090
Brownwood	31	48	98	57	1386	18	22	N	9	2437	101	73	99	73	23	S	96	73	77	76	75	297	1922	1045	3043
Camp Bullis	29	41	98	45	1400	23	28	N	8	1952	100	74	97	74	23	S	94	74	78	77	76	220	1626	1481	3348
Carswell AFB/Fort Worth	32	47	97	26	650	18	23	N	10	2301	101	75	99	75	22	S	97	74	78	77	76	415	1969	1182	2928
Corpus Christi IAP	27	46	97	30	41	31	35	N	12	930	95	78	94	78	17	SSE	92	78	80	80	79	134	2507	3238	3989
Corpus Christi NAS	27	42	97	17	19	34	38	N	12	899	92	79	91	79	12	SE	90	79	82	81	80	15	2845	3329	4036
Dallas/Love Field	32	51	96	51	481	18	22	N	11	2290	102	75	100	75	21	S	97	75	78	78	77	474	2208	1675	3103
Dallas NAS/Hensley Field	32	44	96	58	495	20	25	NNW	9	2308	102	76	100	76	22	S	98	76	79	78	77	497	2229	1764	3092
Del Rio IAP	29	22	100	55	1026	26	31	NNW	9	1523	100	73	98	73	23	SE	97	73	79	77	76	509	2349	1260	3367
Dyess AFB/Abilene	32	25	99	51	1789	15	19	N	9	2682	100	71	98	71	23	S	96	71	75	74	73	342	1700	209	2089
Eagle Pass AFS	28	52	100	32	884	27	32	NNW	9	1423	101	73	99	73	24	ESE	98	73	78	78	77	605	2517	1426	3515
Ellington AFB/Houston	29	37	95	10	40	28	31	N	8	1384	95	78	94	78	19	S	92	78	81	80	80	114	1763	2373	3616
El Paso IAP	31	48	106	24	3918	20	24	N	7	2678	100	64	98	64	25	S	96	64	69	68	68	370	1917	0	376
Fort Bliss/Biggs AAF	31	51	106	23	3947	19	23	N	5	2432	100	65	97	65	25	W	95	65	70	69	68	325	1813	5	373
Fort Hood/Hood AAF	31	09	97	43	923	20	25	N	9	1959	99	73	97	73	23	S	95	73	77	76	75	295	1791	1045	3043
Fort Hood/Robert Gray AAF	31	04	97	50	1015	20	25	N	9	1959	99	73	97	73	23	S	95	73	77	76	75	295	1791	1045	3043
Fort Sam Houston	29	27	98	26	760	25	30	N	8	1570	99	73	97	73	22	SSE	96	73	77	76	76	397	2049	1699	3426
Fort Wolters	32	50	98	04	900	17	21	N	6	2432	102	75	100	74	24	S	98	74	78	77	76	489	1921	1136	2880
Fort Worth IAP	32	50	97	03	537	17	22	NW	11	2382	101	74	99	74	22	S	97	74	78	77	76	469	2095	1415	3087
Galveston	29	18	94	48	7	31	36	N	15	1224	90	79	89	79	9	S	88	78	81	80	80	4	2603	2998	3932
Garland ANG Station	32	54	96	39	558	18	22	NNW	10	2290	102	75	100	75	21	S	97	75	78	78	77	474	2208	1675	3103
Goodfellow AFB/San Angelo	31	26	100	24	1877	18	22	NNE	10	2240	101	71	99	71	24	SSE	97	70	75	74	73	465	1978	245	2424
Harlingen	26	14	97	39	35	35	39	NNW	10	693	96	77	94	77	18	SSE	93	77	80	79	79	223	2442	3294	4059
Hondo MAP	29	21	99	11	901	26	23	N	8	1596	99	74	97	74	22	SSE	95	74	77	77	76	480	2159	1703	3374
Houston IAP	29	58	95	21	96	27	32	NNW	11	1434	96	77	94	77	19	S	92	77	80	79	79	132	1888	2694	3695
Kelly AFB/San Antonio	29	23	98	35	690	26	29	N	8	1520	99	74	97	74	22	SSE	96	74	78	77	76	352	1920	1774	3444
Kingsville NAS	27	29	97	49	50	32	35	N	9	970	97	78	95	78	18	SE	94	78	81	80	80	258	2422	3154	3935
Lackland AFB	29	23	98	37	670	26	29	N	8	1520	99	74	97	74	22	SSE	96	74	78	77	76	352	1920	1774	3444
La Porte ANG Station	29	40	95	04	24	29	32	N	9	1284	94	78	93	78	18	S	91	78	81	80	80	66	1568	2347	3782

D15-13

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**               T R A C E   6 0 0   A N A L Y S I S                      **
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**               by            **
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ESOS STUDY AT WSMR - BUILDING 21140
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:12:46 2/ 6/92
Dataset Name: 21140 .TM

Trane Air Conditioning Economics V 600

By: Trane Customer Direct Service Network PAGE

System 1 Block UH - UNIT HEATERS (Rmt MCR)

	********** COOLING COIL PEAK **********					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0		*	OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-20,499	-20,499	9.03
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	0	0		0	0.00	*	0	0.00	*	-145,467	-145,467	64.06
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-15,312	-15,312	6.74
Infiltration	0			0	0.00	*	0	0.00	*	-45,798	-45,798	20.17
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-227,076	-227,076	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.[illegible]
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.[illegible]
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-227,076	-227,076	100.00

----------COOLING COIL SELECTION----------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

----------AREAS----------

	Gross Total	Glass (sf)	(%)
Floor	11,647		
Part	0		
ExFlr	464		
Roof	11,647	0	0
Wall	12,290	0	0

----------HEATING COIL SELECTION----------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-372.0	10,500	53.6	90.6
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-372.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	1,087
Supply	0	10,500
Mincfm	0	0
Return	0	10,500
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.90
Htg Btuh/SqFt	-31.94

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	90.6
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak SZ - SINGLE ZONE (EVDCOOLGHS) Pml +INCR

	COOLING COIL PEAK					*	CLG SPACE PEAK		*	HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 8/13					*	Mo/Hr: 7/16		*	Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 94/ 64/ 56.0					*	OADB: 97		*	OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	6,056	0		6,056	0.34	*	17,703	6.54	*	0	0	0.00
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	29,084	0		29,084	1.61	*	55,148	20.38	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	35,141	0		35,141	1.95	*	72,851	26.92	*	0	0	0.00
Internal Loads						*			*			
Lights	49,689	0		49,689	2.76	*	49,689	18.36	*	0	0	0.00
People	5,360			5,360	0.30	*	2,760	1.02	*	0	0	0.00
Misc	137,595	0	0	137,595	7.64	*	137,595	50.85	*	0	0	0.00
Sub Total==>	192,644	0	0	192,644	10.69	*	190,044	70.23	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	1,432,192	79.49	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				133,973	7.44	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	7,696			7,696	0.43	*	7,696	2.84	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	235,480	0	0	1,801,645	100.00	*	270,591	100.00	*	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB Deg F	Entering WB Deg F	Entering HR Grains	Leaving DB Deg F	Leaving WB Deg F	Leaving HR Grains
Main Clg	150.1	1,801.6	1,801.0	94,200	93.9	64.0	56.0	73.5	57.5	56.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	150.1	1,801.6								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	11,647		
Part	0		
ExFlr	464		
Roof	11,647	0	0
Wall	12,290	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	94,200	24.0	73.5
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	94,200	0
Infil	0	0
Supply	94,200	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	94,200	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	100.0
Clg Cfm/Sqft	8.09
Clg Cfm/Ton	627.43
Clg Sqft/Ton	77.58
Clg Btuh/Sqft	154.69
No. People	8
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	75.0	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	93.9	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 3 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>		Mo/Hr: 6/14				Mo/Hr: 6/14			Mo/Hr: 0/ 0	
Outside Air ==>		OADB/WB/HR: 97/ 61/ 35.0				OADB: 97			OADB: 0	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	0			0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0		0	0.00	0	0.00	0	0	0.00
Internal Loads										
Lights	1,720	0		1,720	7.56	1,720	7.78	0	0	0.00
People	1,340			1,340	5.89	690	3.12	0	0	0.00
Misc	23,891	0	0	23,891	104.93	23,891	108.01	0	0	0.00
Sub Total==>	26,951	0	0	26,951	118.37	26,301	118.91	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	[illegible]
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	-4,183			-4,183	-18.37	-4,183	-18.91	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	22,768	0	0	22,768	100.00	22,118	100.00	0	0	0.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	2.9	35.0	34.0	1,100	75.0	58.3	58.1	54.0	45.4	38.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.9	35.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	336		
Part	592		
ExFlr	0		
Roof	0	0	0
Wall	0	0	0

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,100	0.0	54.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	0	0
Supply	1,100	0
Mincfm	0	0
Return	1,100	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	3.27
Clg Cfm/Ton	376.71
Clg Sqft/Ton	115.07
Clg Btuh/Sqft	104.29
No. People	2
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	54.0	0.0
Plenum	75.0	0.0
Return	75.0	0.0
Ret/OA	75.0	0.0
Runarnd	75.0	0.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 21140

---------------------------------- B U I L D I N G U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	ROOM 1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM 3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
1	ROOM 1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM 3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
2	ROOM 2	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Zone	2 Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
System	3 Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Building		0.047	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	170.8	34.80

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 21140

---------------------------------- B U I L D I N G A R E A S ----------------------------------

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	3,584	3,584	0	184	0	0	3,584	0	0	5,125
Zone	1 Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM 3	1	1	8,063	8,063	0	280	0	0	8,063	0	0	7,165
Zone	3 Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	1 Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
1	ROOM 1	1	1	3,584	3,584	0	184	0	0	3,584	0	0	5,125
Zone	1 Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM 3	1	1	8,063	8,063	0	280	0	0	8,063	0	0	7,165
Zone	3 Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	2 Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
2	ROOM 2	1	1	336	336	592	0	0	0	0	0	0	0
Zone	2 Total/Ave.				336	592	0	0	0	0	0	0	0
System	3 Total/Ave.				336	592	0	0	0	0	0	0	0
Building					23,630	592	928	0	0	23,294	0	0	24,579

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	7.7	100	8,760	-18,600	17	604	5,290.0	0	0	0.0	0	0
5 - 10	15.3	0	0	-37,200	35	1,281	10,580.0	0	0	0.0	0	0
10 - 15	23.0	0	0	-55,800	45	1,630	15,870.0	57	5,008	0.0	0	0
15 - 20	30.6	0	0	-74,400	4	144	21,160.0	0	0	0.0	0	0
20 - 25	38.3	0	0	-93,000	0	0	26,450.0	0	0	0.0	0	0
25 - 30	45.9	0	0	-111,600	0	0	31,740.0	0	0	0.0	0	0
30 - 35	53.6	0	0	-130,200	0	0	37,030.0	0	0	0.0	0	0
35 - 40	61.2	0	0	-148,800	0	0	42,320.0	0	0	0.0	0	0
40 - 45	68.9	0	0	-167,400	0	0	47,610.0	0	28	0.0	0	0
45 - 50	76.5	0	0	-186,000	0	0	52,900.0	0	0	0.0	0	0
50 - 55	84.2	0	0	-204,600	0	0	58,190.0	0	0	0.0	0	0
55 - 60	91.8	0	0	-223,200	0	0	63,480.0	0	0	0.0	0	0
60 - 65	99.5	0	0	-241,800	0	0	68,770.0	0	0	0.0	0	0
65 - 70	107.1	0	0	-260,400	0	0	74,060.0	0	0	0.0	0	0
70 - 75	114.8	0	0	-279,000	0	0	79,350.0	20	1,736	0.0	0	0
75 - 80	122.4	0	0	-297,600	0	0	84,640.0	0	0	0.0	0	0
80 - 85	130.1	0	0	-316,200	0	0	89,930.0	0	0	0.0	0	0
85 - 90	137.8	0	0	-334,800	0	0	95,220.0	0	0	0.0	0	0
90 - 95	145.4	0	0	-353,400	0	0	100,510.0	0	0	0.0	0	0
95 - 100	153.1	0	0	-372,000	0	0	105,800.0	23	1,988	0.0	0	0
Hours Off	0.0	0	0	0	0	5,101	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)
Jan	17,709	47
Feb	15,162	46
March	11,849	38
April	25,867	105
May	49,426	140
June	71,784	140
July	83,964	140
Aug	77,728	140
Sept	52,065	140
Oct	26,180	105
Nov	11,576	40
Dec	15,376	44
Total	458,686	140

Building Energy Consumption = 66,250 (Btu/Sq Ft/Year)   Floor Area = 23,630 (Sq Ft)
Source Energy Consumption = 66,250 (Btu/Sq Ft/Year)

Σ Monthly KW = 1,125

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 140.1 (kW)
Yearly Time of Peak 16 (hr) 5 (mo)

Hour 16 Month 5

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	DIREVAP	DIRECT EVAP COOLING ONLY	3.7	2.66
Sub Total			3.7	2.66
Sub Total			0.0	0.00
Air Moving Equipment				
2		SUMMATION OF FAN ELECTRICAL DEMAND	106.7	76.19
Sub Total			106.7	76.19
Sub Total			0.0	0.00
Miscellaneous				
Lights			29.6	21.14
Base Utilities			0.0	0.00
Misc Equipment			0.0	0.00
Sub Total			29.6	21.14
Grand Total			140.1	100.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: 21695 – ENERGY EFFICIENT LIGHTING FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/11/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$4,259	
B. SIOH COST	(5.5% of 1A) =		$234	
C. DESIGN COST	(6.0% of 1A) =		$256	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$4,748	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		——————>	$4,748

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	18	$116	15.23	$1,762	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	(12)	($25)	19.64	($500)	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		6	90.2		——————>	$1,262

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$488	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$7,157	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$7,157
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$417	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.35	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$578
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$8,419
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	1.77
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	8.22

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152

PROJECT TITLE: 21695 – ENERGY EFFICIENT WINDOWS   FISCAL YEAR: 1992

DISCRETE PORTION NAME: TOTAL

ANALYSIS DATE: 06/11/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$5,107	
B. SIOH COST	(5.5% of 1A) =		$281	
C. DESIGN COST	(6.0% of 1A) =		$306	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$5,695	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		---------->	$5,695

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	4	$23	15.23	$357	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	3	$6	19.64	$122	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		6	29.6		---------->	$479

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $39

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $573

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $573

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $158

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.11

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$69
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,051
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	0.18
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	82.96

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 21695 - SETBACK/SETUP THERMOSTAT   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/30/92   ECONOMIC LIFE: 15   PREPARED BY: A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=	$136	
B. SIOH COST	(5.5% of 1A) =	$7	
C. DESIGN COST	(6.0% of 1A) =	$8	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$152	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D - 1E) =	------------>	$152

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	124	$806	10.79	$8,696	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	393	$869	12.38	$10,761	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		517	1,675.2		------------>	$19,458

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) = $0

1 DISCOUNT FACTOR (From Table A-2) = 10.67

2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $0

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $6,421

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$1,675
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$19,458
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	128.10
7 SIMPLE PAYBACK (SPB)	(1F/4) =	0.09

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 21695 - DRY BULB ECONOMIZER ON AHU			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/18/92	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$997	
B. SIOH COST	(5.5% of 1A) =		$55	
C. DESIGN COST	(6.0% of 1A) =		$60	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$1,112	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		---------->	$1,112

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	1	$5	10.79	$50	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	0	$0	12.38	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		1	4.6		---------->	$50

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$0	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$0
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$16	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$5
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$50
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(5/1F) =	0.04
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		
7 SIMPLE PAYBACK (SPB)	(1F/4) =	241.95

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO'S - BLDG. 21695

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	166	2.19	363.54	0.09	27.60	403.18		$766.72
	ENERGY EFFICIENT BALLASTS	EA	93	14.06	1307.58	0.85	27.60	2184.35		$3,491.93
	TOTAL									$4,258.65
2	ENERGY EFFICIENT WINDOWS REPLACEMENT									
	WINDOW REPLACEMENT	SF	298	14.83	4419.34	0.067	22.24	444.04		$4,863.38
	DEMOLITION	SF	298	0.16	47.68	0.032	20.58	196.25		$243.93
	TOTAL									$5,107.31
3	SETBACK / SETUP THERMOSTAT (TOTAL)	EA	1	108.63	108.63	1.00	27.63	27.63		$136.26
4	DRY BULB ECONOMIZER ON AHU									
	REFURBISH DAMPER MOTORS, DAMPERS & ACTUATORS	EA	2	75	150.00	4	35.81	286.48		$436.48
	MIXED AIR SENSOR	EA	1	147.50	147.50	0.667	35.81	23.89		$171.39
	RECEIVER CONTROLLER	EA	1	235.00	235.00	1.00	35.81	35.81		$270.81
	TUBING	LF	30	0.70	21.00	0.091	35.81	97.76		$118.76
	TOTAL									$997.44

Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25 % overhead & profit, Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

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**                                                                             **
**              T R A C E   6 0 0   A N A L Y S I S                            **
**                                                                             **
**              by          **
**                                                                             **
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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:55: 1 2/29/92
Dataset Name: 21695 .TM

System 1 Block RAD - RADIATION

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-5,421	-5,421	39.85
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	-5,251	-5,251	38.60
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-891	-891	6.55
Infiltration	0			0	0.00	0	0.00	-2,039	-2,039	14.99
Sub Total==>	0	0		0	0.00	0	0.00	-13,602	-13,602	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-13,602	-13,602	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-12.1	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-12.1			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	48
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-13.75

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

	***** COOLING COIL PEAK *****					***** CLG SPACE PEAK *****		***** HEATING COIL PEAK *****		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/21		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 85		OADB: 0		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	4,682	0		4,682	35.14	6,172	48.80	0	0	0.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	2,220	0		2,220	16.66	6,134	48.49	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	1,067			1,067	8.01	343	2.71	0	0	0.00
Sub Total==>	7,968	0		7,968	59.81	12,649	100.00	0	0	0.00
Internal Loads										
Lights	3,604	0		3,604	27.05	0	0.00	0	0	0.00
People	840			840	6.30	0	0.00	0	0	0.00
Misc	250	0	0	250	1.88	0	0.00	0	0	0.00
Sub Total==>	4,694	0	0	4,694	35.23	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	661	4.96	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	12,662	0	0	13,323	100.00	12,649	100.00	0	0	0.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	1.5	18.0	17.0	468	79.2	56.6	43.5	49.8	39.8	26.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	1.5	18.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	468	1.5	49.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	30	0
Infil	48	0
Supply	468	0
Mincfm	0	0
Return	468	0
Exhaust	30	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	6.4
Clg Cfm/Sqft	0.53
Clg Cfm/Ton	312.25
Clg Sqft/Ton	586.67
Clg Btuh/Sqft	20.45
No. People	2
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)--

Type	Clg	Htg
SADB	49.8	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.2	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 3 Peak SZ - SINGLE ZONE

************************ COOLING COIL PEAK ****************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK	CLG SPACE PEAK	HEATING COIL PEAK
Peaked at Time ==>	Mo/Hr: 7/17	Mo/Hr: 7/20	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0	OADB: 88	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	113,013	0		113,013	18.43	110,219	20.79	-106,293	-106,293	15.11
Glass Solar	6,889	0		6,889	1.12	6,889	1.30	0	0	0.00
Glass Cond	4,500	0		4,500	0.73	4,500	0.85	-10,783	-10,783	1.53
Wall Cond	331,977	0		331,977	54.12	340,490	64.23	-378,688	-378,688	53.84
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-27,565	-27,565	3.92
Infiltration	40,003			40,003	6.52	30,916	5.83	-120,605	-120,605	17.15
Sub Total==>	496,382	0		496,382	80.93	493,014	93.00	-643,935	-643,935	91.56
Internal Loads										
Lights	24,587	0		24,587	4.01	24,587	4.64	0	0	0.00
People	4,200			4,200	0.68	2,300	0.43	0	0	0.00
Misc	10,244	0	0	10,244	1.67	10,244	1.93	0	0	0.00
Sub Total==>	39,031	0	0	39,031	6.36	37,131	7.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	31,513	5.14	0	0.00	0	-91,702	13[illegible]
Sup. Fan Heat				46,432	7.57		0.00		32,337	-[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	535,413	0	0	613,359	100.00	530,146	100.00	-643,935	-703,300	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	51.1	613.4	604.7	21,765	77.4	55.7	42.3	48.3	43.6	41.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	51.1	613.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	16,505		
Part	9,725		
ExFlr	799		
Roof	16,505	0	0
Wall	12,959	186	1

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,083.5	21,765	46.7	98.7
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	21,765	65.6	48.3
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,083.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,082	2,082
Infil	2,738	2,738
Supply	21,765	21,765
Mincfm	0	0
Return	21,765	21,765
Exhaust	2,082	2,082
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	9.6
Clg Cfm/Sqft	1.32
Clg Cfm/Ton	425.82
Clg Sqft/Ton	322.91
Clg Btuh/Sqft	37.16
No. People	20
Htg % OA	9.6
Htg Cfm/SqFt	1.32
Htg Btuh/SqFt	-65.64

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	50.6	100.9
Plenum	76.0	70.0
Return	76.0	70.0
Ret/OA	77.4	65.6
Runarnd	76.0	70.0
Fn MtrTD	0.7	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.7	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 21695

BUILDING U-VALUES

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Building		0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 21695

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Building					18,265	9,725	853	0	0	18,265	186	1	13,215

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	2.6	6	245	-54,778	11	316	1,111.7	0	0	0.0	0	0
5 - 10	5.3	7	290	-109,556	17	513	2,223.3	0	0	0.0	0	0
10 - 15	7.9	7	259	-164,334	17	506	3,335.0	0	0	0.0	0	0
15 - 20	10.5	9	357	-219,112	16	480	4,446.7	0	0	0.0	0	0
20 - 25	13.2	5	188	-273,890	13	398	5,558.4	0	0	0.0	0	0
25 - 30	15.8	5	192	-328,668	12	345	6,670.0	0	0	0.0	0	0
30 - 35	18.4	5	201	-383,446	8	232	7,781.7	0	0	0.0	0	0
35 - 40	21.0	5	178	-438,224	4	127	8,893.4	0	0	0.0	0	0
40 - 45	23.7	6	244	-493,002	1	39	10,005.1	0	0	0.0	0	0
45 - 50	26.3	8	301	-547,780	0	0	11,116.7	0	0	0.0	0	0
50 - 55	28.9	6	218	-602,558	0	0	12,228.4	0	0	0.0	0	0
55 - 60	31.6	8	324	-657,336	0	0	13,340.1	0	0	0.0	0	0
60 - 65	34.2	2	90	-712,114	0	0	14,451.8	0	0	0.0	0	0
65 - 70	36.8	4	175	-766,892	0	0	15,563.4	0	0	0.0	0	0
70 - 75	39.5	6	228	-821,670	0	0	16,675.1	0	0	0.0	0	0
75 - 80	42.1	5	186	-876,448	0	0	17,786.8	0	0	0.0	0	0
80 - 85	44.7	5	186	-931,226	0	0	18,898.4	0	0	0.0	0	0
85 - 90	47.4	2	62	-986,004	0	0	20,010.1	0	0	0.0	0	0
90 - 95	50.0	1	31	-1,040,782	0	0	21,121.8	0	0	0.0	0	0
95 - 100	52.6	0	0	-1,095,560	0	0	22,233.5	100	8,760	0.0	0	0
Hours Off	0.0	0	4,805	0	0	5,804	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	15,865	69	2,919	8
Feb	14,286	69	2,242	7
March	15,525	69	577	4
April	14,811	67	0	0
May	23,409	91	0	0
June	30,383	103	0	0
July	34,850	107	0	0
Aug	33,584	104	0	0
Sept	23,291	91	0	0
Oct	16,041	67	0	0
Nov	14,508	69	807	4
Dec	15,559	69	2,150	6
Total	252,112	107	8,696	8

Building Energy Consumption = 99,514 (Btu/Sq Ft/Year)   Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 101,061 (Btu/Sq Ft/Year)

Σ Monthly KW = 975

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 107.3 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.6	1.52
2	EQ1172L	AIR-CLD COND COMP >55 TONS	38.4	35.81
Sub Total			40.0	37.33
Sub Total			0.0	0.00
Air Moving Equipment				
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.43
Sub Total			11.2	10.43
Sub Total			0.0	0.00
Miscellaneous				
Lights			52.2	48.63
Base Utilities			0.0	0.00
Misc Equipment			3.9	3.62
Sub Total			56.0	52.24
Grand Total			107.3	100.00

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**                  T R A C E   6 0 0   A N A L Y S I S                     **
**                                                                          **
**                  by            **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ~~ALT 1 BSLN~~ ALT2-ECO (REPLACE WINDOWS W/ ENERGY EFFICIENT WINDOWS)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:55: 1 2/29/92
Dataset Name: 21695 .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-5,421	-5,421	39.85
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	-5,251	-5,251	38.60
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-891	-891	6.55
Infiltration	0			0	0.00	0	0.00	-2,039	-2,039	14.99
Sub Total==>	0	0		0	0.00	0	0.00	-13,602	-13,602	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	[illegible]
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-13,602	-13,602	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-12.1	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-12.1			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	48
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-13.75

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/21		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 85		OADB: 0		
Envelope Loads										
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	4,682	0		4,682	35.14	6,172	48.80	0	0	0.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	2,220	0		2,220	16.66	6,134	48.49	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	1,067			1,067	8.01	343	2.71	0	0	0.00
Sub Total==>	7,968	0		7,968	59.81	12,649	100.00	0	0	0.00
Internal Loads										
Lights	3,604	0		3,604	27.05	0	0.00	0	0	0.00
People	840			840	6.30	0	0.00	0	0	0.00
Misc	250	0	0	250	1.88	0	0.00	0	0	0.00
Sub Total==>	4,694	0	0	4,694	35.23	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	661	4.96	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	12,662	0	0	13,323	100.00	12,649	100.00	0	0	0.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	1.5	18.0	17.0	468	79.2	56.6	43.5	49.8	39.8	26.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	1.5	18.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	468	1.5	49.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	30	0
Infil	48	0
Supply	468	0
Mincfm	0	0
Return	468	0
Exhaust	30	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	6.4
Clg Cfm/Sqft	0.53
Clg Cfm/Ton	312.25
Clg Sqft/Ton	586.67
Clg Btuh/Sqft	20.45
No. People	2
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	49.8	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.2	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 3 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr: 7/17				*	Mo/Hr: 7/20		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 96/ 63/ 49.0				*	OADB: 88		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	113,013	0		113,013	18.73	*	110,219	21.14	*	-106,293	-106,293	15.45
Glass Solar	4,655	0		4,655	0.77	*	4,655	0.89	*	0	0	0.00
Glass Cond	1,245	0		1,245	0.21	*	1,245	0.24	*	-2,773	-2,773	0.40
Wall Cond	331,977	0		331,977	55.01	*	340,490	65.32	*	-378,688	-378,688	55.04
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-27,565	-27,565	4.01
Infiltration	36,707			36,707	6.08	*	27,549	5.28	*	-113,334	-113,334	16.47
Sub Total==>	487,597	0		487,597	80.79	*	484,159	92.88	*	-628,654	-628,654	91.37
Internal Loads						*			*			
Lights	24,587	0		24,587	4.07	*	24,587	4.72	*	0	0	0.00
People	4,200			4,200	0.70	*	2,300	0.44	*	0	0	0.00
Misc	10,244	0	0	10,244	1.70	*	10,244	1.97	*	0	0	0.00
Sub Total==>	39,031	0	0	39,031	6.47	*	37,131	7.12	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	31,513	5.22	*	0	0.00	*	0	-91,702	13.33
Sup. Fan Heat				45,381	7.52	*		0.00	*		32,337	-4.70
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	526,628	0	0	603,523	100.00	*	521,290	100.00	*	-628,654	-688,019	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	50.3	603.5	594.8	21,272	77.4	55.7	42.1	48.2	43.5	41.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	50.3	603.5								

--------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	16,505		
Part	9,725		
ExFlr	799		
Roof	16,505	0	0
Wall	12,959	186	1

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,083.5	21,272	45.4	98.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	21,272	65.5	48.2
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,083.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,082	2,082
Infil	2,573	2,573
Supply	21,272	21,272
Mincfm	0	0
Return	21,272	21,272
Exhaust	2,082	2,082
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	9.8
Clg Cfm/SqFt	1.29
Clg Cfm/Ton	422.97
Clg Sqft/Ton	328.18
Clg Btuh/SqFt	36.57
No. People	20
Htg % OA	9.8
Htg Cfm/SqFt	1.29
Htg Btuh/SqFt	-65.64

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	50.4	100.9
Plenum	76.0	70.0
Return	76.0	70.0
Ret/OA	77.4	65.5
Runarnd	76.0	70.0
Fn MtrTD	0.7	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.7	0.0

BUILDING U-VALUES - ALTERNATIVE 2
DBL PANE GREY GLASS - BLDG 21695

BUILDING U-VALUES

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	0.315	0.324	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.315	0.324	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	0.315	0.324	0.645	0.000	110.3	22.96
Building		0.658	0.750	0.000	0.000	0.140	0.315	0.324	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 2
DBL PANE GREY GLASS - BLDG 21695

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Building					18,265	9,725	853	0	0	18,265	186	1	13,215

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	2.6	5	213	-54,778	11	316	1,087.0	0	0	0.0	0	0
5 - 10	5.2	8	303	-109,556	17	513	2,174.1	0	0	0.0	0	0
10 - 15	7.8	7	259	-164,334	18	522	3,261.1	0	0	0.0	0	0
15 - 20	10.4	9	357	-219,112	16	464	4,348.2	0	0	0.0	0	0
20 - 25	12.9	4	172	-273,890	13	398	5,435.2	0	0	0.0	0	0
25 - 30	15.5	4	167	-328,668	11	335	6,522.3	0	0	0.0	0	0
30 - 35	18.1	5	211	-383,446	8	242	609.3	0	0	0.0	0	0
35 - 40	20.7	5	209	-438,224	4	127	8,696.3	0	0	0.0	0	0
40 - 45	23.3	6	253	-493,002	1	39	9,783.4	0	0	0.0	0	0
45 - 50	25.9	7	287	-547,780	0	0	10,870.4	0	0	0.0	0	0
50 - 55	28.5	6	223	-602,558	0	0	11,957.5	0	0	0.0	0	0
55 - 60	31.1	7	274	-657,336	0	0	13,044.5	0	0	0.0	0	0
60 - 65	33.7	4	140	-712,114	0	0	14,131.6	0	0	0.0	0	0
65 - 70	36.3	5	195	-766,892	0	0	15,218.6	0	0	0.0	0	0
70 - 75	38.8	5	208	-821,670	0	0	16,305.6	0	0	0.0	0	0
75 - 80	41.4	4	163	-876,448	0	0	17,392.7	0	0	0.0	0	0
80 - 85	44.0	5	209	-931,226	0	0	18,479.7	0	0	0.0	0	0
85 - 90	46.6	2	62	-986,004	0	0	19,566.8	0	0	0.0	0	0
90 - 95	49.2	1	31	-1,040,782	0	0	20,653.8	0	0	0.0	0	0
95 - 100	51.8	0	0	-1,095,560	0	0	21,740.8	100	8,760	0.0	0	0
Hours Off	0.0	0	4,824	0	0	5,804	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	15,865	69	2,911	7
Feb	14,286	69	2,232	7
March	15,525	69	576	4
April	14,800	67	0	0
May	23,295	91	0	0
June	30,169	102	0	0
July	34,560	107	0	0
Aug	33,333	103	0	0
Sept	23,141	91	0	0
Oct	16,009	67	0	0
Nov	14,508	69	805	4
Dec	15,559	69	2,144	6
Total	251,051	107	8,668	7

Building Energy Consumption = 99,147 (Btu/Sq Ft/Year)   Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 100,689 (Btu/Sq Ft/Year)

Σ Monthly kW = 973

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 106.7 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.6	1.53
2	EQ1172L	AIR-CLD COND COMP >55 TONS	37.9	35.48
Sub Total			39.5	37.00
Sub Total			0.0	0.00
Air Moving Equipment				
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.48
Sub Total			11.2	10.48
Sub Total			0.0	0.00
Miscellaneous				
Lights			52.2	48.87
Base Utilities			0.0	0.00
Misc Equipment			3.9	3.64
Sub Total			56.0	52.51
Grand Total			106.7	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                        **
**                                                                         **
**              by             **
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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ~~ALT 1-BSLN~~, ALT2-ECO (LOW WATTAGE FLUORESCENT LIGHTING)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:55: 1 2/29/92
Dataset Name: 21695 .TM

System 1 Block RAD - RADIATION

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-5,421	-5,421	39.85
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	-5,251	-5,251	38.60
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-891	-891	6.55
Infiltration	0			0	0.00	0	0.00	-2,039	-2,039	14.99
Sub Total==>	0	0		0	0.00	0	0.00	-13,602	-13,602	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-13,602	-13,602	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-12.1	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-12.1			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	48
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-13.75

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

	COOLING COIL PEAK						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16						Mo/Hr: 7/21		Mo/Hr: 0/ 0		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0						OADB: 85		OADB: 0		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)		Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00		0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00		0	0.00	0	0	0.00
Roof Cond	4,682	0		4,682	35.14		6,172	48.80	0	0	0.00
Glass Solar	0	0		0	0.00		0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00		0	0.00	0	0	0.00
Wall Cond	2,220	0		2,220	16.66		6,134	48.49	0	0	0.00
Partition	0			0	0.00		0	0.00	0	0	0.00
Exposed Floor	0			0	0.00		0	0.00	0	0	0.00
Infiltration	1,067			1,067	8.01		343	2.71	0	0	0.00
Sub Total==>	7,968	0		7,968	59.81		12,649	100.00	0	0	0.00
Internal Loads											
Lights	3,604	0		3,604	27.05		0	0.00	0	0	0.00
People	840			840	6.30		0	0.00	0	0	0.00
Misc	250	0	0	250	1.88		0	0.00	0	0	0.00
Sub Total==>	4,694	0	0	4,694	35.23		0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00		0	0.00	0	0	0.00
Outside Air	0	0	0	661	4.96		0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00			0.00		0	0.00
Ret. Fan Heat		0		0	0.00			0.00		0	0.00
Duct Heat Pkup		0		0	0.00			0.00		0	0.00
OV/UNDR Sizing	0			0	0.00		0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00			0.00		0	0.00
Terminal Bypass		0	0	0	0.00			0.00		0	0.00
Grand Total==>	12,662	0	0	13,323	100.00		12,649	100.00	0	0	0.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
Main Clg	1.5	18.0	17.0	468	79.2	56.6	43.5	49.8	39.8	26.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	1.5	18.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	468	1.5	49.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	30	0
Infil	48	0
Supply	468	0
Mincfm	0	0
Return	468	0
Exhaust	30	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	6.4
Clg Cfm/Sqft	0.53
Clg Cfm/Ton	312.25
Clg Sqft/Ton	586.67
Clg Btuh/Sqft	20.45
No. People	2
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

TEMPERATURES (F)

Type	Clg	Htg
SADB	49.8	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.2	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 3 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Peaked at Time ==>		Mo/Hr: 7/17				*	Mo/Hr: 7/20		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 96/ 63/ 49.0				*	OADB: 88		*		OADB: 24	
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	113,013	0		113,013	18.65	*	110,219	21.05	*	-106,293	-106,293	15.11
Glass Solar	6,889	0		6,889	1.14	*	6,889	1.32	*	0	0	0.00
Glass Cond	4,500	0		4,500	0.74	*	4,500	0.86	*	-10,783	-10,783	1.53
Wall Cond	331,977	0		331,977	54.78	*	340,490	65.03	*	-378,688	-378,688	53.84
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-27,565	-27,565	3.92
Infiltration	40,003			40,003	6.60	*	30,916	5.90	*	-120,605	-120,605	17.15
Sub Total==>	496,382	0		496,382	81.90	*	493,014	94.16	*	-643,935	-643,935	91.56
Internal Loads						*			*			
Lights	18,030	0		18,030	2.97	*	18,030	3.44	*	0	0	0.00
People	4,200			4,200	0.69	*	2,300	0.44	*	0	0	0.00
Misc	10,244	0	0	10,244	1.69	*	10,244	1.96	*	0	0	0.00
Sub Total==>	32,475	0	0	32,475	5.36	*	30,575	5.84	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	31,513	5.20	*	0	0.00	*	0	-91,702	13.04
Sup. Fan Heat				45,704	7.54	*		0.00	*		32,337	-4.60
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	528,857	0	0	606,074	100.00	*	523,589	100.00	*	-643,935	-703,300	100.00

------COOLING COIL SELECTION------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	50.5	606.1	597.4	21,424	77.4	55.7	42.2	48.2	43.5	41.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	50.5	606.1								

------AREAS------

	Gross Total	Glass (sf)	(%)
Floor	16,505		
Part	9,725		
ExFlr	799		
Roof	16,505	0	0
Wall	12,959	186	1

------HEATING COIL SELECTION------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,083.5	21,424	46.3	99.2
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	21,424	65.5	48.2
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,083.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,082	2,082
Infil	2,738	2,738
Supply	21,424	21,424
Mincfm	0	0
Return	21,424	21,424
Exhaust	2,082	2,082
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	9.7
Clg Cfm/Sqft	1.30
Clg Cfm/Ton	424.18
Clg Sqft/Ton	326.80
Clg Btuh/Sqft	36.72
No. People	20
Htg % OA	9.7
Htg Cfm/SqFt	1.30
Htg Btuh/SqFt	-65.64

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	50.5	101.4
Plenum	76.0	70.0
Return	76.0	70.0
Ret/OA	77.4	65.5
Runarnd	76.0	70.0
Fn MtrTD	0.7	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.7	0.0

BUILDING U-VALUES - ALTERNATIVE 3
REDUCE LIGHTING ENERGY - BLDG 21695

BUILDING U-VALUES

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Building		0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 3
REDUCE LIGHTING ENERGY - BLDG 21695

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 al/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Building					18,265	9,725	853	0	0	18,265	186	1	13,215

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Per Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	2.6	5	180	-54,778	9	259	1,094.6	0	0	0.0	0	0
5 - 10	5.2	8	314	-109,556	19	570	2,189.2	0	0	0.0	0	0
10 - 15	7.8	6	217	-164,334	17	489	3,283.8	0	0	0.0	0	0
15 - 20	10.4	9	337	-219,112	16	478	4,378.4	0	0	0.0	0	0
20 - 25	13.0	5	208	-273,890	14	407	5,473.0	0	0	0.0	0	0
25 - 30	15.6	6	226	-328,668	12	345	6,567.6	0	0	0.0	0	0
30 - 35	18.2	5	180	-383,446	8	242	7,662.2	0	0	0.0	0	0
35 - 40	20.8	4	155	-438,224	4	127	8,756.8	0	0	0.0	0	0
40 - 45	23.4	7	274	-493,002	1	39	9,851.4	0	0	0.0	0	0
45 - 50	26.0	7	277	-547,780	0	0	10,946.0	0	0	0.0	0	0
50 - 55	28.6	6	242	-602,558	0	0	12,040.6	0	0	0.0	0	0
55 - 60	31.2	7	254	-657,336	0	0	13,135.2	0	0	0.0	0	0
60 - 65	33.8	4	162	-712,114	0	0	14,229.8	0	0	0.0	0	0
65 - 70	36.4	4	165	-766,892	0	0	15,324.4	0	0	0.0	0	0
70 - 75	39.0	5	186	-821,670	0	0	16,419.1	0	0	0.0	0	0
75 - 80	41.6	5	185	-876,448	0	0	17,513.7	0	0	0.0	0	0
80 - 85	44.2	5	197	-931,226	0	0	18,608.3	0	0	0.0	0	0
85 - 90	46.8	2	82	-986,004	0	0	19,702.9	0	0	0.0	0	0
90 - 95	49.4	1	31	-1,040,782	0	0	20,797.5	0	0	0.0	0	0
95 - 100	52.0	0	0	-1,095,560	0	0	21,892.1	100	8,760	0.0	0	0
Hours Off	0.0	0	4,888	0	0	5,804	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	15,499	67	2,946	8
Feb	14,008	67	2,272	7
March	15,131	67	586	4
April	14,365	65	0	0
May	22,892	89	0	0
June	29,861	100	0	0
July	34,356	105	0	0
Aug	33,035	102	0	0
Sept	22,809	89	0	0
Oct	15,555	65	0	0
Nov	14,158	67	825	4
Dec	15,207	67	2,181	6
Total	246,877	105	8,811	8

Building Energy Consumption = 99,146 (Btu/Sq Ft/Year)   Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 100,713 (Btu/Sq Ft/Year)

Σ Monthly KW = 950

UTILITY PEAK CHECKSUMS - ALTERNATIVE 3

------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S -------------------------------------

Utility ELECTRIC DEMAND

Peak Value 104.7 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.6	1.56
2	EQ1172L	AIR-CLD COND COMP >55 TONS	37.8	36.09
Sub Total			39.4	37.64
Sub Total			0.0	0.00
Air Moving Equipment				
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.68
Sub Total			11.2	10.68
Sub Total			0.0	0.00
Miscellaneous				
Lights			50.2	47.97
Base Utilities			0.0	0.00
Misc Equipment			3.9	3.70
Sub Total			54.1	51.67
Grand Total			104.7	100.00

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**                T R A C E   6 0 0   A N A L Y S I S                       **
**                                                                          **
**                by          **
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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ALT 1-BSLN, ALT2-ECO (DRY-BULB ECONOMIZER ON AHU)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 10:47:18 6/18/92
Dataset Name: 21695 .TM

System 1 Block RAD - RADIATION

	************************** COOLING COIL PEAK					**********************************	CLG SPACE PEAK	************		HEATING COIL PEAK ****		
Peaked at Time ==>		Mo/Hr: 0/ 0				*	Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0				*	OADB: 0		*		OADB: 24	
						*			*			
	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads												
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-5,421	-5,421	39.85
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	0	0		0	0.00	*	0	0.00	*	-5,251	-5,251	38.60
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-891	-891	6.55
Infiltration	0			0	0.00	*	0	0.00	*	-2,039	-2,039	14.99
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-13,602	-13,602	100.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	[illegible]
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	[illegible]
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-13,602	-13,602	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-12.1	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-12.1			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	48
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-13.75

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr: 7/16				*	Mo/Hr: 7/21		*		Mo/Hr: 0/ 0	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				*	OADB: 85		*		OADB: 0	
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	4,682	0		4,682	35.14	*	6,172	48.80	*	0	0	0.00
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	2,220	0		2,220	16.66	*	6,134	48.49	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	1,067			1,067	8.01	*	343	2.71	*	0	0	0.00
Sub Total==>	7,968	0		7,968	59.81	*	12,649	100.00	*	0	0	0.00
Internal Loads						*			*			
Lights	3,604	0		3,604	27.05	*	0	0.00	*	0	0	0.00
People	840			840	6.30	*	0	0.00	*	0	0	0.00
Misc	250	0	0	250	1.88	*	0	0.00	*	0	0	0.00
Sub Total==>	4,694	0	0	4,694	35.23	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	661	4.96	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	12,662	0	0	13,323	100.00	*	12,649	100.00	*	0	0	0.00

------------------COOLING COIL SELECTION------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	1.5	18.0	17.0	468	79.2	56.6	43.5	49.8	39.8	26.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	1.5	18.0								

------AREAS------

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	468	1.5	49.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	30	0
Infil	48	0
Supply	468	0
Mincfm	0	0
Return	468	0
Exhaust	30	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	6.4
Clg Cfm/Sqft	0.53
Clg Cfm/Ton	312.25
Clg Sqft/Ton	586.67
Clg Btuh/Sqft	20.45
No. People	2
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	49.8	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.2	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 3 Peak SZ - SINGLE ZONE

************************** COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak					*	Clg Space Peak		*	Heating Coil Peak		
Peaked at Time ==>	Mo/Hr: 7/17					*	Mo/Hr: 7/20		*	Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					*	OADB: 88		*	OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	113,013	0		113,013	18.43	*	110,219	20.79	*	-106,293	-106,293	15.11
Glass Solar	6,889	0		6,889	1.12	*	6,889	1.30	*	0	0	0.00
Glass Cond	4,500	0		4,500	0.73	*	4,500	0.85	*	-10,783	-10,783	1.53
Wall Cond	331,977	0		331,977	54.12	*	340,490	64.23	*	-378,688	-378,688	53.84
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-27,565	-27,565	3.92
Infiltration	40,003			40,003	6.52	*	30,916	5.83	*	-120,605	-120,605	17.15
Sub Total==>	496,382	0		496,382	80.93	*	493,014	93.00	*	-643,935	-643,935	91.56
Internal Loads						*			*			
Lights	24,587	0		24,587	4.01	*	24,587	4.64	*	0	0	0.00
People	4,200			4,200	0.68	*	2,300	0.43	*	0	0	0.00
Misc	10,244	0	0	10,244	1.67	*	10,244	1.93	*	0	0	0.00
Sub Total==>	39,031	0	0	39,031	6.36	*	37,131	7.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	31,513	5.14	*	0	0.00	*	0	-91,702	13.04
Sup. Fan Heat				46,432	7.57	*		0.00	*		32,337	-4.60
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	535,413	0	0	613,359	100.00	*	530,146	100.00	*	-643,935	-703,300	100.00

-----------------------------------COOLING COIL SELECTION------------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	51.1	613.4	604.7	21,765	77.4	55.7	42.3	48.3	43.6	41.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	51.1	613.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	16,505		
Part	9,725		
ExFlr	799		
Roof	16,505	0	0
Wall	12,959	186	1

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,083.5	21,765	46.7	98.7
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	21,765	65.6	48.3
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,083.5			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,082	2,082
Infil	2,738	2,738
Supply	21,765	21,765
Mincfm	0	0
Return	21,765	21,765
Exhaust	2,082	2,082
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	9.6
Clg Cfm/Sqft	1.32
Clg Cfm/Ton	425.82
Clg Sqft/Ton	322.91
Clg Btuh/Sqft	37.16
No. People	20
Htg % OA	9.6
Htg Cfm/SqFt	1.32
Htg Btuh/SqFt	-65.64

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	50.6	100.9
Plenum	76.0	70.0
Return	76.0	70.0
Ret/OA	77.4	65.6
Runarnd	76.0	70.0
Fn MtrTD	0.7	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.7	0.0

BUILDING U-VALUES - ALTERNATIVE 4
DRY BULB ECONOMIZER ON AHU - BLDG 21695

------------------------------- B U I L D I N G   U - V A L U E S -------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Building		0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 4
DRY BULB ECONOMIZER ON AHU - BLDG 21695

------------------------------- B U I L D I N G   A R E A S -------------------------------

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Building					18,265	9,725	853	0	0	18,265	186	1	13,215

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 4

---------- S Y S T E M   L O A D   P R O F I L E ----------

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	2.6	8	315	-54,778	11	316	1,111.7	0	0	0.0	0	0
5 - 10	5.3	8	323	-109,556	17	513	2,223.3	0	0	0.0	0	0
10 - 15	7.9	7	288	-164,334	17	506	3,335.0	0	0	0.0	0	0
15 - 20	10.5	5	205	-219,112	16	480	4,446.7	0	0	0.0	0	0
20 - 25	13.2	5	205	-273,890	13	398	5,558.4	0	0	0.0	0	0
25 - 30	15.8	4	176	-328,668	12	345	6,670.0	0	0	0.0	0	0
30 - 35	18.4	5	189	-383,446	8	232	7,781.7	0	0	0.0	0	0
35 - 40	21.0	5	179	-438,224	4	127	8,893.4	0	0	0.0	0	0
40 - 45	23.7	5	213	-493,002	1	39	10,005.1	0	0	0.0	0	0
45 - 50	26.3	9	362	-547,780	0	0	11,116.7	0	0	0.0	0	0
50 - 55	28.9	6	218	-602,558	0	0	12,228.4	0	0	0.0	0	0
55 - 60	31.6	8	324	-657,336	0	0	13,340.1	0	0	0.0	0	0
60 - 65	34.2	2	90	-712,114	0	0	14,451.8	0	0	0.0	0	0
65 - 70	36.8	4	175	-766,892	0	0	15,563.4	0	0	0.0	0	0
70 - 75	39.5	6	228	-821,670	0	0	16,675.1	0	0	0.0	0	0
75 - 80	42.1	5	186	-876,448	0	0	17,786.8	0	0	0.0	0	0
80 - 85	44.7	5	186	-931,226	0	0	18,898.4	0	0	0.0	0	0
85 - 90	47.4	2	62	-986,004	0	0	20,010.1	0	0	0.0	0	0
90 - 95	50.0	1	31	-1,040,782	0	0	21,121.8	0	0	0.0	0	0
95 - 100	52.6	0	0	-1,095,560	0	0	22,233.5	100	8,760	0.0	0	0
Hours Off	0.0	0	4,805	0	0	5,804	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 4

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	15,865	69	2,919	8
Feb	14,286	69	2,242	7
March	15,525	69	577	4
April	14,629	67	0	0
May	23,104	91	0	0
June	30,182	103	0	0
July	35,069	107	0	0
Aug	33,856	104	0	0
Sept	23,477	91	0	0
Oct	15,843	67	0	0
Nov	14,508	69	807	4
Dec	15,559	69	2,150	6
Total	251,904	107	8,696	8

Building Energy Consumption = 99,474 (Btu/Sq Ft/Year)   Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 101,021 (Btu/Sq Ft/Year)

Σ Monthly kW = 975

UTILITY PEAK CHECKSUMS - ALTERNATIVE 4

---------- U T I L I T Y   P E A K   C H E C K S U M S ----------

Utility ELECTRIC DEMAND

Peak Value 107.3 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.6	1.52
2	EQ1172L	AIR-CLD COND COMP >55 TONS	38.4	35.81
Sub Total			40.0	37.33
Sub Total			0.0	0.00
Air Moving Equipment				
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.43
Sub Total			11.2	10.43
Sub Total			0.0	0.00
Miscellaneous				
Lights			52.2	48.63
Base Utilities			0.0	0.00
Misc Equipment			3.9	3.62
Sub Total			56.0	52.24
Grand Total			107.3	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by          **
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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ~~ALT-1-BSLN~~, ALT2-ECO TEMPERATURE SETBACK

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 10:43:55 3/14/92
Dataset Name: 21695A .TM

System 1 Block RAD - RADIATION

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ***

	COOLING COIL PEAK	CLG SPACE PEAK	HEATING COIL PEAK
Peaked at Time ==>	Mo/Hr: 0/ 0	Mo/Hr: 0/ 0	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	OADB: 0	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-5,421	-5,421	39.85
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	-5,251	-5,251	38.60
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-891	-891	6.55
Infiltration	0			0	0.00	0	0.00	-2,039	-2,039	14.99
Sub Total==>	0	0		0	0.00	0	0.00	-13,602	-13,602	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-13,602	-13,602	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-12.1	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-12.1			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	0	48
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil		0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-13.75

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************* HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/21 * Mo/Hr: 0/ 0
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 85 * OADB: 0

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	4,682	0		4,682	35.14	6,172	48.80	0	0	0.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	2,220	0		2,220	16.66	6,134	48.49	0	0	0.00
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	1,067			1,067	8.01	343	2.71	0	0	0.00
Sub Total==>	7,968	0		7,968	59.81	12,649	100.00	0	0	0.00
Internal Loads										
Lights	3,604	0		3,604	27.05	0	0.00	0	0	0.00
People	840			840	6.30	0	0.00	0	0	0.00
Misc	250	0	0	250	1.88	0	0.00	0	0	0.00
Sub Total==>	4,694	0	0	4,694	35.23	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	661	4.96	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	12,662	0	0	13,323	100.00	12,649	100.00	0	0	0.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	1.5	18.0	17.0	468	79.2	56.6	43.5	49.8	39.8	26.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	1.5	18.0								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	880		
Part	0		
ExFlr	27		
Roof	880	0	0
Wall	221	0	0

-----------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	468	1.5	49.8
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	30	0
Infil	48	0
Supply	468	0
Mincfm	0	0
Return	468	0
Exhaust	30	0
Rm Exh	0	0
Auxil		0

--ENGINEERING CHECKS--

Clg % OA	6.4
Clg Cfm/Sqft	0.53
Clg Cfm/Ton	312.25
Clg Sqft/Ton	586.67
Clg Btuh/Sqft	20.45
No. People	2
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	49.8	0.0
Plenum	78.0	0.0
Return	78.0	0.0
Ret/OA	79.2	0.0
Runarnd	78.0	0.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

System 3 Peak SZ - SINGLE ZONE

***** COOLING COIL PEAK *****						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/17					Mo/Hr: 7/20		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 96/ 63/ 49.0					OADB: 88		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	113,013	0		113,013	18.43	110,219	20.79	-106,293	-106,293	15.11
Glass Solar	6,889	0		6,889	1.12	6,889	1.30	0	0	0.00
Glass Cond	4,500	0		4,500	0.73	4,500	0.85	-10,783	-10,783	1.53
Wall Cond	331,977	0		331,977	54.12	340,490	64.23	-378,688	-378,688	53.84
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-27,565	-27,565	3.92
Infiltration	40,003			40,003	6.52	30,916	5.83	-120,605	-120,605	17.15
Sub Total==>	496,382	0		496,382	80.93	493,014	93.00	-643,935	-643,935	91.56
Internal Loads										
Lights	24,587	0		24,587	4.01	24,587	4.64	0	0	0.00
People	4,200			4,200	0.68	2,300	0.43	0	0	0.00
Misc	10,244	0	0	10,244	1.67	10,244	1.93	0	0	0.00
Sub Total==>	39,031	0	0	39,031	6.36	37,131	7.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	31,513	5.14	0	0.00	0	-91,702	13.04
Sup. Fan Heat				46,432	7.57		0.00		32,337	-4.60
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	535,413	0	0	613,359	100.00	530,146	100.00	-643,935	-703,300	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	51.1	613.4	604.7	21,765	77.4	55.7	42.3	48.3	43.6	41.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	51.1	613.4								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	16,505		
Part	9,725		
ExFlr	799		
Roof	16,505	0	0
Wall	12,959	186	1

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-1,083.5	21,765	46.7	98.7
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	21,765	65.6	48.3
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,083.5			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	2,082	2,082
Infil	2,738	2,738
Supply	21,765	21,765
Mincfm	0	0
Return	21,765	21,765
Exhaust	2,082	2,082
Rm Exh	0	0
Auxil		0

ENGINEERING CHECKS

Clg % OA	9.6
Clg Cfm/Sqft	1.32
Clg Cfm/Ton	425.82
Clg Sqft/Ton	322.91
Clg Btuh/Sqft	37.16
No. People	20
Htg % OA	9.6
Htg Cfm/SqFt	1.32
Htg Btuh/SqFt	-65.64

TEMPERATURES (F)

Type	Clg	Htg
SADB	50.6	100.9
Plenum	76.0	70.0
Return	76.0	70.0
Ret/OA	77.4	65.6
Runarnd	76.0	70.0
Fn MtrTD	0.7	0.0
Fn BldTD	0.6	0.0
Fn Frict	1.7	0.0

BUILDING U-VALUES - ALTERNATIVE 1
ECO - NIGHT SETBACK - BLDG 21695

B U I L D I N G U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Building		0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 1
ECO - NIGHT SETBACK - BLDG 21695

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Building					18,265	9,725	853	0	0	18,265	186	1	13,215

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	2.6	10	223	-54,778	20	252	1,111.7	0	0	0.0	0	0
5 - 10	5.3	12	279	-109,556	14	176	2,223.3	0	0	0.0	0	0
10 - 15	7.9	6	125	-164,334	12	153	3,335.0	0	0	0.0	0	0
15 - 20	10.5	6	125	-219,112	18	239	4,446.7	0	0	0.0	0	0
20 - 25	13.2	4	93	-273,890	9	119	5,558.4	0	0	0.0	0	0
25 - 30	15.8	4	80	-328,668	7	96	6,670.0	0	0	0.0	0	0
30 - 35	18.4	3	73	-383,446	1	11	7,781.7	0	0	0.0	0	0
35 - 40	21.0	4	88	-438,224	2	27	8,893.4	0	0	0.0	0	0
40 - 45	23.7	6	145	-493,002	0	0	10,005.1	0	0	0.0	0	0
45 - 50	26.3	8	185	-547,780	3	41	11,116.7	0	0	0.0	0	0
50 - 55	28.9	6	140	-602,558	1	16	12,228.4	0	0	0.0	0	0
55 - 60	31.6	3	71	-657,336	0	3	13,340.1	0	0	0.0	0	0
60 - 65	34.2	4	82	-712,114	1	8	14,451.8	0	0	0.0	0	0
65 - 70	36.8	5	117	-766,892	9	110	15,563.4	0	0	0.0	0	0
70 - 75	39.5	4	79	-821,670	2	27	16,675.1	0	0	0.0	0	0
75 - 80	42.1	4	89	-876,448	1	10	17,786.8	0	0	0.0	0	0
80 - 85	44.7	1	20	-931,226	0	4	18,898.4	0	0	0.0	0	0
85 - 90	47.4	0	0	-986,004	0	0	20,010.1	0	0	0.0	0	0
90 - 95	50.0	0	0	-1,040,782	0	0	21,121.8	0	0	0.0	0	0
95 - 100	52.6	10	235	-1,095,560	0	0	22,233.5	100	8,760	0.0	0	0
Hours Off	0.0	0	6,511	0	0	7,468	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	14,909	69	1,620	14
Feb	13,429	69	1,248	13
March	15,294	69	346	11
April	14,201	67	0	0
May	19,148	91	0	0
June	23,852	103	0	0
July	26,429	107	0	0
Aug	26,205	104	0	0
Sept	18,494	91	0	0
Oct	14,979	67	0	0
Nov	14,154	69	454	11
Dec	14,549	69	1,099	13
Total	215,642	107	4,767	14

Building Energy Consumption = 69,757 (Btu/Sq Ft/Year)   Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 70,605 (Btu/Sq Ft/Year)

Σ Monthly kW = 975

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S --------------------------------------

Utility ELECTRIC DEMAND

Peak Value 107.3 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.7	1.55
2	EQ1172L	AIR-CLD COND COMP >55 TONS	38.4	35.79
Sub Total			40.1	37.34
Sub Total			0.0	0.00
Air Moving Equipment				
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.43
Sub Total			11.2	10.43
Sub Total			0.0	0.00
Miscellaneous				
Lights			52.2	48.61
Base Utilities			0.0	0.00
Misc Equipment			3.9	3.62
Sub Total			56.0	52.23
Grand Total			107.3	100.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range | REGION: 4 | PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 21695 – MOD. CONFIG. (ECOs LIGHTING; SETBACK T-STAT) | FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/22/92 | ECONOMIC LIFE: 15 | PREPARED BY: A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=		$4,395	
B. SIOH COST	(5.5% of 1A) =		$242	
C. DESIGN COST	(6.0% of 1A) =		$264	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$4,901	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		———>	$4,901

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	142	$921	10.79	$9,936	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	385	$852	12.38	$10,542	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		527	1,772.4		———>	$20,478

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $488
1 DISCOUNT FACTOR (From Table A-2) = 10.67
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $5,202

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $5,202

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $6,758
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F =
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$2,260
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$25,680
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	5.24
7 SIMPLE PAYBACK (SPB)	(1F/4) =	2.17

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 21695 - SETBACK/SETUP THERMOSTAT (MODIFIED CONFIG.)			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/19/92	ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=	$136		
B. SIOH COST	(5.5% of 1A) =	$7		
C. DESIGN COST	(6.0% of 1A) =	$8		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$152		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	————>	$152	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	122	$792	10.79	$8,551	
B. DIST		0	$0	11.57	$0	
C. NAT GAS	$2.21	390	$862	12.38	$10,671	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		512	1,654.4		————>	$19,222

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELECT. DEMAND SAVINGS)	=		($59)	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		($624)	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		($624)
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$6,343	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$1,596
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$18,598
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	122.44
7 SIMPLE PAYBACK (SPB)	(1F/4) =	0.10

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: 21695 - ENERGY EFFICIENT LIGHTING (MODIFIED CONFIG.) FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/19/92 ECONOMIC LIFE: 25 PREPARED BY: A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=		$4,259	
B. SIOH COST	(5.5% of 1A) =		$234	
C. DESIGN COST	(6.0% of 1A) =		$256	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$4,748	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		---------->	$4,748

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	29	$189	15.23	$2,873	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	377	$834	19.64	$16,381	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		406	1,022.7		---------->	$19,254

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = $488
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $7,157

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $7,157

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $6,354
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = $5
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =		$1,510
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =		$26,411
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =		5.56
7 SIMPLE PAYBACK (SPB)	(1F/4) =		3.14

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO'S FOR MODIFIED CONFIGURATION – BLDG. 21695

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	166	2.19	363.54	0.09	27.60	403.18		$766.72
	ENERGY EFFICIENT BALLASTS	EA	93	14.06	1307.58	0.85	27.60	2184.35		$3,491.93
	TOTAL									$4,258.65
2	SETBACK / SETUP THERMOSTAT (TOTAL)	EA	1	108.63	108.63	1.00	27.63	27.63		$136.26
	TOTAL FOR MODIFIED CONFIGURATION									$4,394.91

Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25 % overhead & profit, Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2,3,4 - SYNG (MODIFIED BASELINE)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:51:55 6/18/92
Dataset Name: 21695M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	14,543	67	1,643	14
Feb	13,098	67	1,267	13
March	14,900	67	351	11
April	13,765	65	0	0
May	18,655	89	0	0
June	23,338	100	0	0
July	25,943	105	0	0
Aug	25,664	102	0	0
Sept	18,034	89	0	0
Oct	14,500	65	0	0
Nov	13,804	67	470	11
Dec	14,198	67	1,116	13
Total	210,442	105	4,847	14

Building Energy Consumption = 69,194 (Btu/Sq Ft/Year)   Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 70,056 (Btu/Sq Ft/Year)

≤ KW 950

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**              T R A C E   6 0 0   A N A L Y S I S                         **
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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2,3,4 - SYNG (SETBACK-SETUP T-STAT)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17:29: 0 6/18/92
Dataset Name: 21695M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	15,499	67	2,930	8
Feb	13,955	67	2,252	7
March	15,131	67	579	4
April	14,375	65	0	0
May	22,840	88	0	0
June	29,740	100	0	0
July	34,187	104	0	0
Aug	32,899	101	0	0
Sept	22,750	89	0	0
Oct	15,560	65	0	0
Nov	14,158	67	818	4
Dec	15,207	67	2,165	6
Total	246,303	104	8,743	8

Building Energy Consumption = 98,643 (Btu/Sq Ft/Year)　　Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 100,198 (Btu/Sq Ft/Year)

$\Sigma KW = 947$

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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2,3,4 - SYNG (ENERGY EFFICIENT LIGHTING)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 6: 4 6/18/92
Dataset Name: 21695M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	15,865	69	2,898	8
Feb	14,286	69	2,224	7
March	15,510	69	568	4
April	14,201	67	0	0
May	19,148	91	0	0
June	23,852	103	0	0
July	26,429	107	0	0
Aug	26,205	104	0	0
Sept	18,494	91	0	0
Oct	14,979	67	0	0
Nov	14,508	69	797	4
Dec	15,501	69	2,130	6
Total	218,978	107	8,617	8

Building Energy Consumption = 92,556 (Btu/Sq Ft/Year)   Floor Area = 17,385 (Sq Ft)
Source Energy Consumption = 94,089 (Btu/Sq Ft/Year)

ΣKW= 975

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: 24072 – ENERGY EFFICIENT LIGHTING FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/17/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$11,338	
B. SIOH COST	(5.5% of 1A) =		$624	
C. DESIGN COST	(6.0% of 1A) =		$680	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$12,642	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		———>	$12,642

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	711	$4,604	15.23	$70,123	
B. DIST		0	$0	17.28	$0	
C. PROPANE	$6.71	(334)	($2,243)	19.64	($44,056)	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		377	2,361.1		———>	$26,068

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $4,154
1 DISCOUNT FACTOR (From Table A-2) = 14.68
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $60,973

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $60,973

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $8,602
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 2.74
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$6,515
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$87,041
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	6.88
7 SIMPLE PAYBACK (SPB)	(1F/4) =	1.94

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 24072 – SETBACK/SETUP THERMOSTAT – MODIFY CONTROLS			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/30/92	ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=		$2,016	
B. SIOH COST	(5.5% of 1A) =		$111	
C. DESIGN COST	(6.0% of 1A) =		$121	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$2,248	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		————>	$2,248

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	190	$1,230	10.79	$13,269	
B. DIST		0	$0	11.57	$0	
C. PROPANE	$6.71	169	$1,136	12.38	$14,064	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		359	2,365.7		————>	$27,332

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELECT. DEMAND SAVINGS)	=		$936	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$9,987	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$9,987
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$9,020	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	16.17	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/15)) =	$3,302
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$37,319
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	16.60
7 SIMPLE PAYBACK (SPB)	(1F/4) =	0.68

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 24072 - DRY-BULB ECONOMIZER ON AHU   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/10/92   ECONOMIC LIFE: 15   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$2,047	
B. SIOH COST	(5.5% of 1A) =	$113	
C. DESIGN COST	(6.0% of 1A) =	$123	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$2,282	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$2,282

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	10	$66	10.79	$714	
B. DIST		0	$0	11.57	$0	
C. PROPANE	$6.71	0	$0	12.38	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		10	66.2		————>	$714

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) = $39
1 DISCOUNT FACTOR (From Table A-2) = 10.67
2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $416

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $416

D. PROJECT NON-ENERGY TEST
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $236
a IF 3D1 => 3C THEN GO TO 4
b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.42
c IF 3D1b => 1 THEN GO TO 4
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/15)) =	$105
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,131
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.50
7 SIMPLE PAYBACK (SPB)	(1F/4) =	21.69

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO'S – BLDG. 24072

PROPOSED TOTAL CONTRACT PRICE

PURCHASE REQUEST NUMBER

PROJECT NUMBER

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	234	2.19	512.46	0.09	27.60	568.34		$1,080.80
	ENERGY EFFICIENT BALLASTS	EA	117	14.06	1645.02	0.85	27.60	2748.05		$4,393.07
	LIGHTING BRANCH CIRCUITS	LF	1988	1.06	2104.74	0.07	27.60	3588.97		$5,693.71
	LIGHTING SWITCHES	EA	12	6.06	72.72	0.30	27.60	98.04		$170.76
	LIGHTING PANEL BOARD	EA	1	317.2	317.20	7.00	27.60	193.20		$510.40
	TOTAL									$11,338.33
2	MODIFY CONTROLS - INSTALL SETBACK/SETUP THERMOSTAT									
	SETBACK/SETUP THERMOSTAT	EA	1	108.6	108.6	1.00	27.63	27.63		$136.26
	2" CONTROL VALVE - STEAM	EA	1	494.0	494.0	2.00	35.81	71.62		$565.62
	3" CONTROL VALVE - CHILLED WATER	EA	1	1056.0	1056.0	4.00	35.81	143.24		$1,199.24
	PRESSURE/ELECTRIC SWITCH	EA	1	87.5	87.5	1.00	27.63	27.63		$115.13
	TOTAL									$2,016.25

Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25% overhead & profit, Labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 (Overhead & Profit included); Richardson Cost Estimating Guide, 1992

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): ECO'S - BLDG. 24072	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
3	INSTALL DRY-BULB ECONOMIZER ON AHU									
	MIXED AIR SENSOR	EA	1	148	147.5	0.67	35.81	23.99		$171.49
	RECEIVER CONTROLLER	EA	1	235	235	2.00	35.81	71.62		$306.62
	LOW-LEAKAGE DAMPERS	EA	2	217	434	6.00	27.63	331.56		$765.56
	PNEUMATIC ACCUTATORS	EA	2	226	452	1.00	27.63	55.26		$507.26
	PNEUMATIC TUBING	LF	90	0.80	72	0.09	27.63	223.80		$295.80
	TOTAL									$2,046.74

Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25% overhead & profit, Labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 (Overhead & Profit included); [illegible]chardson Cost Estimating Guide, 1992

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**              T R A C E   6 0 0   A N A L Y S I S                           **
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**              by          **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT: ALT 1-BSLN, ALTS 2,3,4 -ECOS (BASELINE)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:44:18 6/15/92
Dataset Name: 24072 .TM

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ***

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	47,136	0		47,136	14.90	56,918	17.04	-60,935	-60,935	9.52
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	67,040	0		67,040	21.20	76,571	22.93	-151,335	-151,335	23.65
Partition	13,840			13,840	4.38	13,840	4.14	-110,718	-110,718	17.30
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	29,500			29,500	9.33	102,293	30.63	-211,356	-211,356	33.03
Sub Total==>	157,516	0		157,516	49.81	249,621	74.75	-534,345	-534,345	83.51
Internal Loads										
Lights	46,854	0		46,854	14.82	46,854	14.03	0	0	0.00
People	4,020			4,020	1.27	2,394	0.72	0	0	0.00
Misc	31,741	0	0	31,741	10.04	31,741	9.51	12,000	12,000	-1.88
Sub Total==>	82,614	0	0	82,614	26.12	80,989	24.25	12,000	12,000	-1.88
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	33,118	10.47	0	0.00	0	-117,543	18.37
Sup. Fan Heat				39,680	12.55		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	3,320			3,320	1.05	3,320	0.99	0	0	-0.00
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	243,450	0	0	316,248	100.00	333,930	100.00	-522,345	-639,888	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	26.4	316.2	421.2	27,900	77.3	60.2	63.6	61.0	56.1	70.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	26.4	316.2								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	33,125		
Part	23,574		
ExFlr	0		
Roof	12,463	0	0
Wall	6,408	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-639.9	27,900	63.6	87.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	27,900	63.6	61.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-639.9			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,790	2,790
Infil	5,017	5,017
Supply	27,900	27,900
Mincfm	0	0
Return	27,900	27,900
Exhaust	2,790	2,790
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	0.84
Clg Cfm/Ton	1058.66
Clg Sqft/Ton	1256.92
Clg Btuh/Sqft	9.55
No. People	9
Htg % OA	10.0
Htg Cfm/SqFt	0.84
Htg Btuh/SqFt	-19.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	62.5	87.6
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	77.3	63.6
Runarnd	75.0	68.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 2 Peak INCHP - INCREMENTAL HEAT PUMP

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads										
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	6,182	0		6,182	14.51	6,182	15.39	-8,554	-8,554	52.79
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	0	0	0.00
Partition	476			476	1.12	476	1.19	-3,811	-3,811	23.52
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	2,641			2,641	6.20	1,946	4.84	-3,839	-3,839	23.69
Sub Total==>	9,299	0		9,299	21.83	8,604	21.41	-16,204	-16,204	100.00
Internal Loads										
Lights	26,048	0		26,048	61.14	26,048	64.83	0	0	0.00
People	2,680			2,680	6.29	1,380	3.43	0	0	0.00
Misc	4,147	0	0	4,147	9.73	4,147	10.32	0	0	0.00
Sub Total==>	32,875	0	0	32,875	77.17	31,575	78.59	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				427	1.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	42,174	0	0	42,601	100.00	40,179	100.00	-16,204	-16,204	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	3.6	42.6	40.6	1,200	75.2	53.4	36.2	39.8	36.9	32.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	3.6	42.6								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	2,430		
Part	711		
ExFlr	0		
Roof	2,430	0	0
Wall	0	0	0

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-25.8	1,200	59.6	82.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,200	68.0	39.7
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-25.8			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	0	0
Infil	91	91
Supply	1,200	1,200
Mincfm	0	0
Return	1,200	1,200
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.49
Clg Cfm/Ton	338.02
Clg Sqft/Ton	684.50
Clg Btuh/Sqft	17.53
No. People	4
Htg % OA	0.0
Htg Cfm/SqFt	0.49
Htg Btuh/SqFt	-10.62

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	40.0	82.1
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	75.0	68.0
Runarnd	75.0	68.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 24072

B U I L D I N G   U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Building		0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 24072

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	2ND FLR- GRD LVL	1	1	7,757	7,757	0	0	0	0	7,757	0	0	3,906
Zone	1 Total/Ave.				7,757	0	0	0	0	7,757	0	0	3,906
2	1ST FLR MEZZ LVL	1	1	11,568	11,568	2,706	0	0	0	4,706	0	0	2,502
Zone	2 Total/Ave.				11,568	2,706	0	0	0	4,706	0	0	2,502
3	BASEMENT	1	1	13,800	13,800	20,868	0	0	0	0	0	0	0
Zone	3 Total/Ave.				13,800	20,868	0	0	0	0	0	0	0
System	1 Total/Ave.				33,125	23,574	0	0	0	12,463	0	0	6,408
4	1ST FLR OFC AREA	1	1	2,430	2,430	711	0	0	0	2,430	0	0	0
Zone	4 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
System	2 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
Building					35,555	24,285	0	0	0	14,893	0	0	6,408

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	1.5	31	2,751	-33,284	9	320	1,455.0	0	0	0.0	0	0
5 - 10	3.0	27	2,337	-66,569	11	399	2,910.0	0	0	0.0	0	0
10 - 15	4.5	0	0	-99,853	9	327	4,365.0	0	0	0.0	0	0
15 - 20	6.0	5	414	-133,138	10	378	5,820.0	0	0	0.0	0	0
20 - 25	7.5	3	232	-166,422	11	390	7,275.0	0	0	0.0	0	0
25 - 30	9.0	1	53	-199,707	12	434	8,730.0	0	0	0.0	0	0
30 - 35	10.5	1	90	-232,991	18	637	10,185.0	0	0	0.0	0	0
35 - 40	12.0	1	97	-266,275	9	340	11,640.0	0	0	0.0	0	0
40 - 45	13.5	3	244	-299,560	6	235	13,095.0	0	0	0.0	0	0
45 - 50	15.0	2	140	-332,844	5	164	14,550.0	0	0	0.0	0	0
50 - 55	16.4	4	311	-366,129	0	0	16,005.0	0	0	0.0	0	0
55 - 60	17.9	6	499	-399,413	0	0	17,460.0	0	0	0.0	0	0
60 - 65	19.4	5	447	-432,698	0	0	18,915.0	0	0	0.0	0	0
65 - 70	20.9	8	722	-465,982	0	0	20,370.0	0	0	0.0	0	0
70 - 75	22.4	4	363	-499,266	0	0	21,825.0	0	0	0.0	0	0
75 - 80	23.9	1	60	-532,551	0	0	23,280.0	0	0	0.0	0	0
80 - 85	25.4	0	0	-565,835	0	0	24,735.0	0	0	0.0	0	0
85 - 90	26.9	0	0	-599,120	0	0	26,190.0	0	0	0.0	0	0
90 - 95	28.4	0	0	-632,404	0	0	27,645.0	0	0	0.0	0	0
95 - 100	29.9	0	0	-665,688	0	0	29,100.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	5,136	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	34,927	53	2,610	6
Feb	31,774	53	1,832	6
March	35,974	53	244	3
April	29,012	46	0	0
May	40,561	69	0	0
June	45,363	79	0	0
July	50,110	82	0	0
Aug	46,849	79	0	0
Sept	37,944	67	0	0
Oct	30,208	56	0	0
Nov	34,172	53	317	3
Dec	35,798	53	1,585	4
Total	452,691	82	6,590	6

Building Energy Consumption = 61,988 (Btu/Sq Ft/Year)   Floor Area = 35,555 (Sq Ft)
Source Energy Consumption = 62,562 (Btu/Sq Ft/Year)

$\Sigma KW = 743$ Baseline

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 82.5 (kW)
Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	34.6	41.93
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	4.6	5.59
Sub Total			39.2	47.52
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.09
Sub Total			14.9	18.09
Sub Total			0.0	0.00
Miscellaneous				
Lights			21.4	25.90
Base Utilities			0.0	0.00
Misc Equipment			7.0	8.49
Sub Total			28.4	34.39
Grand Total			82.5	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                        **
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**              by             **
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT: ALT 1-BSLN, ALTS 2,3,4 -ECOS (ENERGY EFFICIENT LIGHTING)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 15:18: 9 6/15/92
Dataset Name: 24072 .TM

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ***

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	47,136	0		47,136	15.15	56,918	17.04	-60,935	-60,935	9.52
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	67,040	0		67,040	21.54	76,571	22.93	-151,335	-151,335	23.65
Partition	13,840			13,840	4.45	13,840	4.14	-110,718	-110,718	17.30
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	29,522			29,522	9.49	102,293	30.63	-211,356	-211,356	33.03
Sub Total==>	157,538	0		157,538	50.63	249,621	74.75	-534,345	-534,345	83.51
Internal Loads										
Lights	8,645	0		8,645	2.78	13,749	4.12	0	0	0.00
People	4,020			4,020	1.29	2,394	0.72	0	0	0.00
Misc	31,741	0	0	31,741	10.20	31,741	9.51	12,000	12,000	-1.88
Sub Total==>	44,406	0	0	44,406	14.27	47,884	14.34	12,000	12,000	-1.88
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	33,124	10.64	0	0.00	0	-117,543	18.37
Sup. Fan Heat				39,680	12.75		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	36,425			36,425	11.71	36,425	10.91	0	0	[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	238,369	0	0	311,173	100.00	333,930	100.00	-522,345	-639,888	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	25.9	311.2	416.1	27,900	77.3	60.2	63.6	61.0	56.2	70.8
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	25.9	311.2								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	33,125		
Part	23,574		
ExFlr	0		
Roof	12,463	0	0
Wall	6,408	0	0

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-639.9	27,900	63.6	87.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	27,900	63.6	61.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-639.9			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	2,790	2,790
Infil	5,017	5,017
Supply	27,900	27,900
Mincfm	0	0
Return	27,900	27,900
Exhaust	2,790	2,790
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	0.84
Clg Cfm/Ton	1075.93
Clg Sqft/Ton	1277.43
Clg Btuh/Sqft	9.39
No. People	9
Htg % OA	10.0
Htg Cfm/SqFt	0.84
Htg Btuh/SqFt	-19.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	62.5	87.6
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	77.3	63.6
Runarnd	75.0	68.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 2 Peak INCHP - INCREMENTAL HEAT PUMP

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	6,182	0		6,182	27.31	6,182	28.25	-8,554	-8,554	52.79
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	0	0	0.00
Partition	476			476	2.10	476	2.18	-3,811	-3,811	23.52
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	972			972	4.29	1,946	8.89	-3,839	-3,839	23.69
Sub Total==>	7,630	0		7,630	33.71	8,604	39.31	-16,204	-16,204	100.00
Internal Loads										
Lights	7,754	0		7,754	34.25	7,754	35.43	0	0	0.00
People	2,680			2,680	11.84	1,380	6.31	0	0	0.00
Misc	4,147	0	0	4,147	18.32	4,147	18.95	0	0	0.00
Sub Total==>	14,581	0	0	14,581	64.41	13,281	60.69	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				427	1.88		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	22,212	0	0	22,638	100.00	21,885	100.00	-16,204	-16,204	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
Main Clg	1.9	22.6	22.3	1,200	75.2	60.2	66.7	55.7	53.2	66.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	1.9	22.6								

Entering DB/WB/HR; Leaving DB/WB/HR

AREAS

	Gross Total	Glass (sf)	(%)
Floor	2,430		
Part	711		
ExFlr	0		
Roof	2,430	0	0
Wall	0	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-25.8	1,200	59.6	82.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,200	68.0	55.6
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-25.8			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	91	91
Supply	1,200	1,200
Mincfm	0	0
Return	1,200	1,200
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.49
Clg Cfm/Ton	636.09
Clg Sqft/Ton	1288.09
Clg Btuh/Sqft	9.32
No. People	4
Htg % OA	0.0
Htg Cfm/SqFt	0.49
Htg Btuh/SqFt	-10.62

TEMPERATURES (F)

Type	Clg	Htg
SADB	56.0	82.1
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	75.0	68.0
Runarnd	75.0	68.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

BUILDING U-VALUES - ALTERNATIVE 2
ENERGY EFFICIENT LIGHTING - BLDG 24072

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.5.32	
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Building		0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 2
ENERGY EFFICIENT LIGHTING - BLDG 24072

---------------------------------- B U I L D I N G   A R E A S ----------------------------------

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	2ND FLR- GRD LVL	1	1	7,757	7,757	0	0	0	0	7,757	0	0	3,906
Zone	1 Total/Ave.				7,757	0	0	0	0	7,757	0	0	3,906
2	1ST FLR MEZZ LVL	1	1	11,568	11,568	2,706	0	0	0	4,706	0	0	2,502
Zone	2 Total/Ave.				11,568	2,706	0	0	0	4,706	0	0	2,502
3	BASEMENT	1	1	13,800	13,800	20,868	0	0	0	0	0	0	0
Zone	3 Total/Ave.				13,800	20,868	0	0	0	0	0	0	0
System	1 Total/Ave.				33,125	23,574	0	0	0	12,463	0	0	6,408
4	1ST FLR OFC AREA	1	1	2,430	2,430	711	0	0	0	2,430	0	0	0
Zone	4 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
System	2 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
Building					35,555	24,285	0	0	0	14,893	0	0	6,408

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	1.4	1	51	-33,284	0	0	1,455.0	0	0	0.0	0	0
5 - 10	2.8	0	10	-66,569	6	225	2,910.0	0	0	0.0	0	0
10 - 15	4.2	17	651	-99,853	9	327	4,365.0	0	0	0.0	0	0
15 - 20	5.6	3	101	-133,138	10	377	5,820.0	0	0	0.0	0	0
20 - 25	7.0	6	237	-166,422	11	394	7,275.0	0	0	0.0	0	0
25 - 30	8.3	3	117	-199,707	8	281	8,730.0	0	0	0.0	0	0
30 - 35	9.7	4	159	-232,991	13	476	10,185.0	0	0	0.0	0	0
35 - 40	11.1	3	117	-266,275	14	504	11,640.0	0	0	0.0	0	0
40 - 45	12.5	10	378	-299,560	15	556	13,095.0	0	0	0.0	0	0
45 - 50	13.9	13	466	-332,844	8	279	14,550.0	0	0	0.0	0	0
50 - 55	15.3	17	622	-366,129	6	205	16,005.0	0	0	0.0	0	0
55 - 60	16.7	12	453	-399,413	0	0	17,460.0	0	0	0.0	0	0
60 - 65	18.1	8	281	-432,698	0	0	18,915.0	0	0	0.0	0	0
65 - 70	19.5	2	80	-465,982	0	0	20,370.0	0	0	0.0	0	0
70 - 75	20.9	0	0	-499,266	0	0	21,825.0	0	0	0.0	0	0
75 - 80	22.3	0	0	-532,551	0	0	23,280.0	0	0	0.0	0	0
80 - 85	23.6	0	0	-565,835	0	0	24,735.0	0	0	0.0	0	0
85 - 90	25.0	0	0	-599,120	0	0	26,190.0	0	0	0.0	0	0
90 - 95	26.4	0	0	-632,404	0	0	27,645.0	0	0	0.0	0	0
95 - 100	27.8	0	0	-665,688	0	0	29,100.0	100	8,760	0.0	0	0
Hours Off	0.0	0	5,037	0	0	5,136	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	17,904	38	3,206	7
Feb	16,251	38	2,455	6
March	18,837	38	908	3
April	12,884	35	0	0
May	22,370	49	0	0
June	26,930	58	0	0
July	30,789	61	0	0
Aug	27,705	57	0	0
Sept	20,958	49	0	0
Oct	13,477	31	0	0
Nov	17,992	38	1,031	4
Dec	18,249	38	2,333	5
Total	244,345	61	9,933	7

Building Energy Consumption = 51,393 (Btu/Sq Ft/Year)   Floor Area = 35,555 (Sq Ft)
Source Energy Consumption = 52,258 (Btu/Sq Ft/Year)

Σ KW = 530

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

UTILITY PEAK CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 60.6 (kW)
Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	31.4	51.81
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	2.5	4.07
Sub Total			33.8	55.88
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	24.63
Sub Total			14.9	24.63
Sub Total			0.0	0.00
Miscellaneous				
Lights			4.8	7.93
Base Utilities			0.0	0.00
Misc Equipment			7.0	11.55
Sub Total			11.8	19.49
Grand Total			60.6	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                          **
**              by              **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT: ALT 1-BSLN, ALTS 2,3,4 -ECOS (SETBACK-SETUP T-STAT/MODIFY CONTROLS)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 7:55:20 6/16/92
Dataset Name: 24072 .TM

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK *****

						*			*			
Peaked at Time ==>		Mo/Hr: 7/16				*	Mo/Hr: 7/16		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				*	OADB: 97		*		OADB: 24	

	ace Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	*	Space Sensible (Btuh)	Percnt Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	42,981	0		42,981	14.48	*	52,763	20.15	*	-60,935	-60,935	9.52
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	56,722	0		56,722	19.11	*	66,253	25.31	*	-151,335	-151,335	23.65
Partition	-27,680			-27,680	-9.32	*	-27,680	-10.57	*	-110,718	-110,718	17.30
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	58,486			58,486	19.70	*	87,882	33.57	*	-211,356	-211,356	33.03
Sub Total==>	130,510	0		130,510	43.96	*	179,218	68.46	*	-534,345	-534,345	83.51
Internal Loads						*			*			
Lights	46,854	0		46,854	15.78	*	46,854	17.90	*	0	0	0.00
People	4,020			4,020	1.35	*	2,394	0.91	*	0	0	0.00
Misc	31,741	0	0	31,741	10.69	*	31,741	12.12	*	12,000	12,000	-1.88
Sub Total==>	82,614	0	0	82,614	27.83	*	80,989	30.94	*	12,000	12,000	-1.88
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	42,469	14.31	*	0	0.00	*	0	-117,543	18.37
Sup. Fan Heat				39,680	13.37	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	1,594			1,594	0.54	*	1,594	0.61	*	0	0	-0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	[illegible]
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.[illegible]
						*			*			
Grand Total==>	214,718	0	0	296,867	100.00	*	261,801	100.00	*	-522,345	-639,888	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	24.7	296.9	341.0	2900	80.0	59.2	54.3	66.7	55.3	57.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	24.7	296.9								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	33,125		
Part	23,574		
ExFlr	0		
Roof	12,463	0	0
Wall	6,408	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-639.9	27,900	63.6	87.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	27,900	63.6	66.7
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-639.9			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,790	2,790
Infil	5,017	5,017
Supply	27,900	27,900
Mincfm	0	0
Return	27,900	27,900
Exhaust	2,790	2,790
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	0.84
Clg Cfm/Ton	1127.78
Clg Sqft/Ton	1338.98
Clg Btuh/Sqft	8.96
No. People	9
Htg % OA	10.0
Htg Cfm/SqFt	0.84
Htg Btuh/SqFt	-19.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	68.2	87.6
Plenum	78.0	68.0
Return	78.0	68.0
Ret/OA	80.0	63.6
Runarnd	78.0	68.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 2 Peak INCHP - INCREMENTAL HEAT PUMP

************************* COOLING COIL PEAK ****************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr: 7/16				*	Mo/Hr: 7/16		*	Mo/Hr: 13/ 1		
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				*	OADB: 97		*	OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	6,182	0		6,182	14.51	*	6,182	15.39	*	-8,554	-8,554	52.79
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Partition	476			476	1.12	*	476	1.19	*	-3,811	-3,811	23.52
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	2,641			2,641	6.20	*	1,946	4.84	*	-3,839	-3,839	23.69
Sub Total==>	9,299	0		9,299	21.83	*	8,604	21.41	*	-16,204	-16,204	100.00
Internal Loads						*			*			
Lights	26,048	0		26,048	61.14	*	26,048	64.83	*	0	0	0.00
People	2,680			2,680	6.29	*	1,380	3.43	*	0	0	0.00
Misc	4,147	0	0	4,147	9.73	*	4,147	10.32	*	0	0	0.00
Sub Total==>	32,875	0	0	32,875	77.17	*	31,575	78.59	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan Heat				427	1.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	42,174	0	0	42,601	100.00	*	40,179	100.00	*	-16,204	-16,204	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	3.6	42.6	40.6	1,200	75.2	53.4	36.2	39.8	36.9	32.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	3.6	42.6								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	2,430		
Part	711		
ExFlr	0		
Roof	2,430	0	0
Wall	0	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-25.8	1,200	59.6	82.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,200	68.0	39.7
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-25.8			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	91	91
Supply	1,200	1,200
Mincfm	0	0
Return	1,200	1,200
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.49
Clg Cfm/Ton	338.02
Clg Sqft/Ton	684.50
Clg Btuh/Sqft	17.53
No. People	4
Htg % OA	0.0
Htg Cfm/SqFt	0.49
Htg Btuh/SqFt	-10.62

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	40.0	82.1
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	75.0	68.0
Runarnd	75.0	68.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

BUILDING U-VALUES - ALTERNATIVE 3
SETBACK

---------------------------------- B U I L D I N G   U - V A L U E S ----------------------------------

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Building		0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 3
SETBACK

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	2ND FLR- GRD LVL	1	1	7,757	7,757		0	0	0	7,757	0	0	3,906
Zone	1 Total/Ave.				7,757	0	0	0	0	7,757	0	0	3,906
2	1ST FLR MEZZ LVL	1	1	11,568	11,568	2,706	0	0	0	4,706	0	0	2,502
Zone	2 Total/Ave.				11,568	2,706	0	0	0	4,706	0	0	2,502
3	BASEMENT	1	1	13,800	13,800	20,868	0	0	0	0	0	0	0
Zone	3 Total/Ave.				13,800	20,868	0	0	0	0	0	0	0
System	1 Total/Ave.				33,125	23,574	0	0	0	12,463	0	0	6,408
4	1ST FLR OFC AREA	1	1	2,430	2,430	711	0	0	0	2,430	0	0	0
Zone	4 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
System	2 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
Building					35,555	24,285	0	0	0	14,893	0	0	6,408

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	1.4	22	1,324	-33,284	17	254	1,455.0	0	0	0.0	0	0
5 - 10	2.8	16	1,007	-66,569	12	169	2,910.0	0	0	0.0	0	0
10 - 15	4.2	26	1,567	-99,853	9	130	4,365.0	0	0	0.0	0	0
15 - 20	5.7	2	136	-133,138	5	74	5,820.0	0	0	0.0	0	0
20 - 25	7.1	9	550	-166,422	7	109	7,275.0	0	0	0.0	0	0
25 - 30	8.5	4	272	-199,707	3	49	8,730.0	0	0	0.0	0	0
30 - 35	9.9	1	59	-232,991	6	84	10,185.0	0	0	0.0	0	0
35 - 40	11.3	1	79	-266,275	3	47	11,640.0	0	0	0.0	0	0
40 - 45	12.7	1	70	-299,560	5	69	13,095.0	0	0	0.0	0	0
45 - 50	14.1	2	109	-332,844	4	60	14,550.0	0	0	0.0	0	0
50 - 55	15.6	1	59	-366,129	0	4	16,005.0	0	0	0.0	0	0
55 - 60	17.0	5	298	-399,413	0	4	17,460.0	0	0	0.0	0	0
60 - 65	18.4	5	301	-432,698	3	38	18,915.0	0	0	0.0	0	0
65 - 70	19.8	1	70	-465,982	0	4	20,370.0	0	0	0.0	0	0
70 - 75	21.2	2	142	-499,266	1	16	21,825.0	0	0	0.0	0	0
75 - 80	22.6	0	0	-532,551	1	19	23,280.0	0	0	0.0	0	0
80 - 85	24.0	0	15	-565,835	3	38	24,735.0	0	0	0.0	0	0
85 - 90	25.5	0	0	-599,120	1	14	26,190.0	0	0	0.0	0	0
90 - 95	26.9	0	28	-632,404	7	98	27,645.0	0	0	0.0	0	0
95 - 100	28.3	0	30	-665,688	13	185	29,100.0	100	8,760	0.0	0	0
Hours Off	0.0	0	2,644	0	0	7,295	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	31,742	53	1,743	10
Feb	28,369	53	1,313	11
March	32,452	53	309	9
April	28,558	47	0	2
May	33,258	67	0	0
June	38,222	77	0	0
July	41,646	80	0	0
Aug	39,398	76	0	0
Sept	31,905	67	0	0
Oct	29,610	63	0	0
Nov	30,826	53	399	9
Dec	31,061	53	1,132	10
Total	397,046	80	4,897	11

Building Energy Consumption = 51,887 (Btu/Sq Ft/Year)   Floor Area = 35,555 (Sq Ft)
Source Energy Consumption = 52,313 (Btu/Sq Ft/Year)

Σ KW = 695

UTILITY PEAK CHECKSUMS - ALTERNATIVE 3

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 79.7 (kW)
Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	31.7	39.76
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	4.7	5.93
Sub Total			36.4	45.68
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.73
Sub Total			14.9	18.73
Sub Total			0.0	0.00
Miscellaneous				
Lights			21.4	26.81
Base Utilities			0.0	0.00
Misc Equipment			7.0	8.78
Sub Total			28.4	35.59
Grand Total			79.7	100.00

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**                                                                          **
**                T R A C E   6 0 0   A N A L Y S I S                       **
**                                                                          **
**                by          **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT: ALT 1 - DRY-BULB ECONOMIZER

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 11:15:31 6/17/92
Dataset Name: 24072EC .TM

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ********************************* CLG SPACE PEAK ************ HEATING COIL PEAK ****

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	47,136	0		47,136	15.07	56,918	17.18	-60,935	-60,935	9.52
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	67,040	0		67,040	21.44	76,571	23.12	-151,335	-151,335	23.65
Partition	13,840			13,840	4.43	13,840	4.18	-110,718	-110,718	17.30
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	28,877			28,877	9.23	102,293	30.88	-211,356	-211,356	33.03
Sub Total==>	156,893	0		156,893	50.17	249,621	75.36	-534,345	-534,345	83.51
Internal Loads										
Lights	46,854	0		46,854	14.98	46,854	14.14	0	0	0.00
People	4,020			4,020	1.29	2,394	0.72	0	0	0.00
Misc	31,741	0	0	31,741	10.15	31,741	9.58	12,000	12,000	-1.88
Sub Total==>	82,614	0	0	82,614	26.42	80,989	24.45	12,000	12,000	-1.88
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	32,869	10.51	0	0.00	0	-117,543	18.37
Sup. Fan Heat				39,680	12.69		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	649			649	0.21	649	0.20	0	0	-0[illegible]
Exhaust Heat		0	0	0	0.00		0.00		0	0[illegible]
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	240,156	0	0	312,706	100.00	331,259	100.00	-522,345	-639,888	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	26.1	312.7	418.5	27,900	77.3	60.3	63.8	61.1	56.2	70.7
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	26.1	312.7								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	33,125		
Part	23,574		
ExFlr	0		
Roof	12,463	0	0
Wall	6,408	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-639.9	27,900	63.6	87.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	27,900	63.6	61.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-639.9			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	2,790	2,790
Infil	5,017	5,017
Supply	27,900	27,900
Mincfm	0	0
Return	27,900	27,900
Exhaust	2,790	2,790
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	0.84
Clg Cfm/Ton	1070.66
Clg Sqft/Ton	1271.16
Clg Btuh/Sqft	9.44
No. People	9
Htg % OA	10.0
Htg Cfm/SqFt	0.84
Htg Btuh/SqFt	-19.32

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	62.6	87.6
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	77.3	63.6
Runarnd	75.0	68.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 2 Peak INCHP - INCREMENTAL HEAT PUMP

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==>		Mo/Hr: 7/16				Mo/Hr: 7/16			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				OADB: 97			OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	6,182	0		6,182	14.51	6,182	15.39	-8,554	-8,554	52.79
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	0	0	0.00
Partition	476			476	1.12	476	1.19	-3,811	-3,811	23.52
Exposed Floor	0			0	0.00	0	0.00	0	0	0.00
Infiltration	2,641			2,641	6.20	1,946	4.84	-3,839	-3,839	23.69
Sub Total==>	9,299	0		9,299	21.83	8,604	21.41	-16,204	-16,204	100.00
Internal Loads										
Lights	26,048	0		26,048	61.14	26,048	64.83	0	0	0.00
People	2,680			2,680	6.29	1,380	3.43	0	0	0.00
Misc	4,147	0	0	4,147	9.73	4,147	10.32	0	0	0.00
Sub Total==>	32,875	0	0	32,875	77.17	31,575	78.59	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				427	1.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	42,174	0	0	42,601	100.00	40,179	100.00	-16,204	-16,204	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	3.6	42.6	40.6	1,200	75.2	53.4	36.2	39.8	36.9	32.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	3.6	42.6								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	2,430		
Part	711		
ExFlr	0		
Roof	2,430	0	0
Wall	0	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-25.8	1,200	59.6	82.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	1,200	68.0	39.7
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-25.8			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	91	91
Supply	1,200	1,200
Mincfm	0	0
Return	1,200	1,200
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	0.49
Clg Cfm/Ton	338.02
Clg Sqft/Ton	684.50
Clg Btuh/Sqft	17.53
No. People	4
Htg % OA	0.0
Htg Cfm/SqFt	0.49
Htg Btuh/SqFt	-10.62

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	40.0	82.1
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	75.0	68.0
Runarnd	75.0	68.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.2	0.0

BUILDING U-VALUES - ALTERNATIVE 1
DRY-BULB ECONOMIZER - BLDG 24072

B U I L D I N G   U - V A L U E S

Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
		Room U-Values (Btu/hr/sqft/F)										
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Building		0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 1
DRY-BULB ECONOMIZER - BLDG 24072

B U I L D I N G   A R E A S

Room Number	Description	Number of Duplicate Flr	Number of Duplicate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	2ND FLR- GRD LVL	1	1	7,757	7,757	0	0	0	0	7,757	0	0	3,906
Zone	1 Total/Ave.				7,757	0	0	0	0	7,757	0	0	3,906
2	1ST FLR MEZZ LVL	1	1	11,568	11,568	2,706	0	0	0	4,706	0	0	2,502
Zone	2 Total/Ave.				11,568	2,706	0	0	0	4,706	0	0	2,502
3	BASEMENT	1	1	13,800	13,800	20,868	0	0	0	0	0	0	0
Zone	3 Total/Ave.				13,800	20,868	0	0	0	0	0	0	0
System	1 Total/Ave.				33,125	23,574	0	0	0	12,463	0	0	6,408
4	1ST FLR OFC AREA	1	1	2,430	2,430	711	0	0	0	2,430	0	0	0
Zone	4 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
System	2 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
Building					35,555	24,285	0	0	0	14,893	0	0	6,408

SYSTEM LOAD PROFILE - ALTERNATIVE 1

Main System 1 SZ SINGLE ZONE

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	1.3	5	168	-31,994	9	320	1,395.0	0	0	0.0	0	0
5 - 10	2.6	7	271	-63,989	10	364	2,790.0	0	0	0.0	0	0
10 - 15	3.9	4	164	-95,983	9	331	4,185.0	0	0	0.0	0	0
15 - 20	5.2	2	71	-127,978	10	379	5,580.0	0	0	0.0	0	0
20 - 25	6.5	2	81	-159,972	9	335	6,975.0	0	0	0.0	0	0
25 - 30	7.8	3	120	-191,967	11	390	8,370.0	0	0	0.0	0	0
30 - 35	9.1	3	126	-223,961	19	687	9,765.0	0	0	0.0	0	0
35 - 40	10.4	4	144	-255,955	9	322	11,160.0	0	0	0.0	0	0
40 - 45	11.7	4	136	-287,950	7	249	12,555.0	0	0	0.0	0	0
45 - 50	13.0	7	241	-319,944	7	247	13,950.0	0	0	0.0	0	0
50 - 55	14.3	12	437	-351,939	0	0	15,345.0	0	0	0.0	0	0
55 - 60	15.6	8	290	-383,933	0	0	16,740.0	0	0	0.0	0	0
60 - 65	16.9	23	851	-415,927	0	0	18,135.0	0	0	0.0	0	0
65 - 70	18.2	7	262	-447,922	0	0	19,530.0	0	0	0.0	0	0
70 - 75	19.5	8	310	-479,916	0	0	20,925.0	0	0	0.0	0	0
75 - 80	20.8	0	0	-511,911	0	0	22,320.0	0	0	0.0	0	0
80 - 85	22.1	0	0	-543,905	0	0	23,715.0	0	0	0.0	0	0
85 - 90	23.5	0	0	-575,900	0	0	25,110.0	0	0	0.0	0	0
90 - 95	24.8	0	0	-607,894	0	0	26,505.0	0	0	0.0	0	0
95 - 100	26.1	0	0	-639,888	0	0	27,900.0	100	8,760	0.0	0	0
Hours Off	0.0	0	5,088	0	0	5,136	0.0	0	0	0.0	0	8,760

Main System 2 INCHP INCREMENTAL HEAT PUMP

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	0.2	0	0	-1,290	0	0	60.0	0	0	0.0	0	0
5 - 10	0.4	0	0	-2,580	0	0	120.0	0	0	0.0	0	0
10 - 15	0.5	0	0	-3,870	0	0	180.0	0	0	0.0	0	0
15 - 20	0.7	0	0	-5,160	0	0	240.0	0	0	0.0	0	0
20 - 25	0.9	1	59	-6,450	0	0	300.0	0	0	0.0	0	0
25 - 30	1.1	6	501	-7,740	0	0	360.0	0	0	0.0	0	0
30 - 35	1.2	12	1,055	-9,030	0	0	420.0	0	0	0.0	0	0
35 - 40	1.4	9	804	-10,320	0	0	480.0	0	0	0.0	0	0
40 - 45	1.6	9	749	-11,610	0	0	540.0	0	0	0.0	0	0
45 - 50	1.8	6	533	-12,900	0	0	600.0	0	0	0.0	0	0
50 - 55	2.0	8	667	-14,190	0	0	660.0	0	0	0.0	0	0
55 - 60	2.1	6	564	-15,480	0	0	720.0	0	0	0.0	0	0
60 - 65	2.3	7	589	-16,770	0	0	780.0	0	0	0.0	0	0
65 - 70	2.5	7	581	-18,060	0	0	840.0	0	0	0.0	0	0
70 - 75	2.7	10	836	-19,350	0	0	900.0	0	0	0.0	0	0
75 - 80	2.8	6	496	-20,640	0	0	960.0	0	0	0.0	0	0
80 - 85	3.0	8	673	-21,930	0	0	1,020.0	0	0	0.0	0	0
85 - 90	3.2	4	369	-23,220	0	0	1,080.0	0	0	0.0	0	0
90 - 95	3.4	3	224	-24,510	0	0	1,140.0	0	0	0.0	0	0
95 - 100	3.6	1	60	-25,800	0	0	1,200.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	8,760	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	34,927	53	2,610	6
Feb	31,774	53	1,832	6
March	35,974	53	244	3
April	29,012	46	0	0
May	39,436	68	0	0
June	44,708	79	0	0
July	49,798	82	0	0
Aug	46,492	79	0	0
Sept	37,566	67	0	0
Oct	30,039	55	0	0
Nov	34,172	53	317	3
Dec	35,798	53	1,585	4
Total	449,695	82	6,590	6

Building Energy Consumption = 61,701 (Btu/Sq Ft/Year)   Floor Area = 35,555 (Sq Ft)
Source Energy Consumption = 62,274 (Btu/Sq Ft/Year)

Σ Kw = 741

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

--------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S ---------------------------------------

Utility   ELECTRIC DEMAND

Peak Value   82.2   (kW)
Yearly Time of Peak   15 (hr)   7 (mo)

Hour 15   Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	34.3	41.74
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	4.6	5.61
Sub Total			38.9	47.35
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.15
Sub Total			14.9	18.15
Sub Total			0.0	0.00
Miscellaneous				
Lights			21.4	25.98
Base Utilities			0.0	0.00
Misc Equipment			7.0	8.51
Sub Total			28.4	34.50
Grand Total			82.2	100.00

JOB WSMR Proj. No. 1110-000

SHEET NO. (1) OF 5

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY A.J.N. DATE 6-12-92

CHECKED BY ________ DATE ________

BLDG. 24072 LIGHTING ECO

SCALE ________

BASEMENT

- Illumination Required = 5 foot candles (similar to storage lighting)
- Lumens / fixture = 5300 lumens (2 - 34 WATT - 4 ft lamps)
- Reflectance Color = Grey
- h = height from Lighting fixture to floor = 10 ft.
- Total S.F. = 9380 S.F.
- Length & Width of Area = Perimeter ÷ 2 = 250 ft.

Calculations

Room Cavity Ratio (RCR) = $\dfrac{(5)(10')(250')}{9380\text{ S.F.}} = 1.33$

Coefficient of Utilitization (CU) = 0.63 from Fig. 9-62

Required # of Fixtures = $\dfrac{(9380\text{ S.F.})(5\text{ fc})}{(5300\text{ lumens})(0.65)(0.63)} = 21.6 = 22$ fixtures

Material List

- 4' energy efficient lamps : 44
- Energy efficient ballasts : 22
- Lighting Branch Circuit : $\left.\begin{array}{l}A = 298\text{ ft. (east)}\\ B = 254\text{ ft. (west)}\end{array}\right\}$ 552 ft.
- 2 Lighting switches

Schedule of Operation

1 hr. per day, 5 days per week

E M C ENGINEERS, INC.
Denver • Colorado Springs • Atlanta • Germany

JOB WSMR Proj. No. 1110-000
SHEET NO. 2 OF 5
CALCULATED BY A. J. N. DATE 6-12-92
CHECKED BY DATE
SCALE

BLDG. 24072 LIGHTING ECO

Ground Floor Office Area/Lounge

- Illumination Required = 25 foot Candles
- Lumens/fixture = 5300 lumens
- Reflectance Color = Off white
- h = 9 ft.
- Total S.F. = 3,240 ft²
- Length & Width of Area = 126 ft.

Calculations

$$RCR = \frac{(5)(9')(126\text{ ft})}{3240\text{ S.F.}} = 1.75$$

$$CU = 0.59 \text{ from Fig 9-62}$$

$$\text{Required \# of Fixtures} = \frac{(3240\text{ s.f.})(25\text{ fc})}{(5300\text{ lumens})(0.65)(0.59)} = 39.85 = 40 \text{ fixtures}$$

Material List

- 4' energy efficient lamps: 68
- Energy efficient ballasts: 34
- Lighting Branch Circuits:
  - (1) 190 ft.
  - (2) 134 ft
  - (3) 120 ft

  } 444 ft.
- Lighting Switches: 4

Schedule of Operation

8 hrs. per day, 5 days per week.

JOB WSMR Proj. No. 1110-000

SHEET NO. 3 OF 5

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY A.J.N. DATE 6-12-92

CHECKED BY ______ DATE ______

SCALE ______

BLDG 24072 Lighting ECO

GROUND FLOOR WORK AREA

- Rewire / Relamp all fluorescent fixtures (except 8 fixtures).

Material List

- 4' energy efficient lamps: 46
- Energy efficient ballasts: 23
- Lighting Branch Circuits: (1) 252 ft, (2) 85 ft } 337 ft.
- Lighting Switches: 2

Schedule of Operation

8 hrs per day, 5 days per week

JOB WSMR Proj. No. 1110-000

SHEET NO. (4) OF 5

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY A.J.N. DATE 6-12-92

CHECKED BY DATE

SCALE

BLDG. 24072 LIGHTING ECO

Mezzanine Storage / Work Area

- Illumination Required = 15 foot candles
- Lumens / fixture = 5300 lumens.
- Reflectance Color = Grey
- h = 9 ft.
- Tot. S.F. = 2986 S.F.
- Length & Width of Area. = 112 ft.

Calculations

$$RCR = \frac{(5)(9\,ft)(112\,ft)}{2986\,S.F.} = 1.69$$

CU = 0.60 from Fig. 9-62

$$\text{Req. \# of Fixtures} = \frac{(2986\,S.F.)(15\,fc)}{(5300\,lumens)(0.65)(0.59)} = 22.04 = 22 \text{ fixtures.}$$

Material List

- 4' energy efficient lamps: 46
- Energy efficient ballasts: 23
- Lighting Branch Circuits: $\left.\begin{array}{l}\text{147 ft (west)}\\ \text{225 ft (east)}\end{array}\right\}$ 372 ft.
- Lighting Switches : 2

Schedule of Operation

2 hrs per day, 5 days per week.

JOB WSMR Proj. No 1110-000

SHEET NO. 3 OF 5

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY A.J.N. DATE 6-12-92

CHECKED BY DATE

SCALE

BLDG. 24872 LIGHTING ECO

SECOND FLOOR (TOP FLOOR)

- Illumination Required = 10 foot candles. (Similar to corridor lighting)
- Lumens / fixture = 5300 lumens.
- Reflectance Color = Grey
- $h = 9$ ft.
- Total S.F. = 2489 S.F.
- Length & Width of Area = 144 ft.

Calculations

$$RCR = \frac{(5)(9')(144 \text{ ft.})}{2489 \text{ S.F.}} = 2.6$$

$$CU = 0.52$$

$$\text{Required No. Fixtures} = \frac{(2489 \text{ S.F.})(10)}{(5300 \text{ lumens})(0.65)(0.52)} = 13.89 = 14 \text{ fixtures.}$$

Material List

- 4' energy efficient lamps : 30
- Energy efficient ballasts : 15
- Lighting branch circuit : 283 ft.
- Lighting switches : 2

Schedule of Operation

1 hr. per day, 5 days per week.

reaching the work-plane, divided by the area of the work-plane. The average value determined this way may vary considerably from that obtained by averaging discrete values of illuminance at several points.

In addition to measurement uncertainties, calculated illuminance values may differ from measured values due to luminaire input data, assumed room and system parameters and mathematical modeling of the lighting system. For example: individual lamps may vary from nominal ratings; individual luminaires may differ from the nominal photometric data due to manufacturing and lamp positioning differences; and assumed values for room reflectances and ballast factor may vary from actual values. In addition, the mathematical model is not an exact representation of most real rooms. For a complete discussion of uncertainties, see reference 25.

Calculation Procedure. Fig. 9–36 provides a procedure for calculating average maintained illuminance using the *Zonal-Cavity Method*.[22–24] The paragraphs that follow discuss the calculation of *cavity ratios* and *effective cavity reflectances* and the selection of *luminaire coefficients of utilization* to be used in the Method.

Cavity Ratios. In the Zonal-Cavity Method, the effects of room proportions, luminaire suspension length, and work-plane height upon the coefficient of utilization are respectively accounted for by the *Room Cavity Ratio*, *Ceiling Cavity Ratio* and *Floor Cavity Ratio*. These ratios are determined by dividing the room into three cavities as shown by Fig. 9–37 and substituting dimensions (in feet or meters) in the following formula:

$$\text{Cavity Ratio} = \frac{5h(\text{Room Length} + \text{Room Width})}{(\text{Room Length}) \times (\text{Room Width})}$$

where

$h = h_{RC}$ for the Room Cavity Ratio, RCR
$= h_{CC}$ for the Ceiling Cavity Ratio, CCR
$= h_{FC}$ for the Floor Cavity Ratio, FCR

Note that

$$\text{CCR} = \text{RCR}\,\frac{h_{CC}}{h_{RC}}$$

and

$$\text{FCR} = \text{RCR}\,\frac{h_{FC}}{h_{RC}}$$

Cavity Ratios may also be obtained from Fig. 9–38.

The illuminance in rooms of irregular shape can be determined by calculating the Room Cavity Ratio using the following formula and solving the problem in the usual manner:

$$\text{Cavity Ratio} = \frac{2.5 \times (\text{Cavity Height}) \times (\text{Cavity Perimeter})}{(\text{Area of Cavity Base})}$$

Effective Cavity Reflectances. Fig. 9–39 provides a means of converting the combination of wall and ceiling or wall and floor reflectances into a single *Effective Ceiling Cavity Reflectance*, ρ_{CC}, and a single *Effective Floor Cavity Reflectance*, ρ_{FC}. In calculations, ceiling, wall and floor reflectances should be initial values. The RSDD factor (see page 9–9) compensates for the decrease of reflectance with time. Note that for surface-mounted and recessed luminaires, CCR = 0 and the ceiling reflectance may be used as ρ_{CC}.

A rectangular cavity consists of four walls, each having a reflectance of ρ_W, and a base of reflectance ρ_B (ceiling or floor). The effective reflectance, ρ_{eff}, of this cavity is the ratio of flux reflected out, divided by the flux entering the cavity through its opening. If the reflectances are assumed to be perfectly diffuse and the flux is assumed to enter the cavity in a perfectly diffuse way, it is possible to calculate the effective cavity reflectance using flux transfer theory (see page 9–3). The result is:

$$\rho_{eff} = \frac{\rho_B\rho_W f\left[\dfrac{2A_B}{A_W}(1-f) - f\right] + \rho_B f^2 + \rho_W\dfrac{A_B}{A_W}(1-f)^2}{1 - \rho_B\rho_W\dfrac{A_B}{A_W}(1-f)^2 - \rho_W\left[1 - 2\dfrac{A_B}{A_W}(1-f)\right]}$$

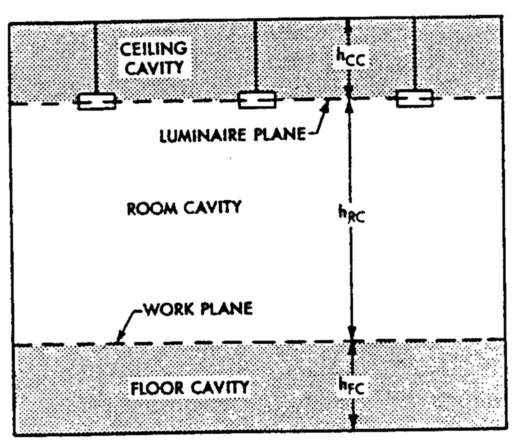


Fig. 9–37. Cavities used in the Zonal-Cavity Method.

Fig. 9-36. Average Illuminance Calculation Sheet

GENERAL INFORMATION

Project identification: ______________________________
(Give name of area and/or building and room number)

Average maintained illuminance for design: ___ lux or
: ___ footcandles

Lamp data:

Type and color: ________

Number per luminaire: ________

Total lumens per luminaire: ________

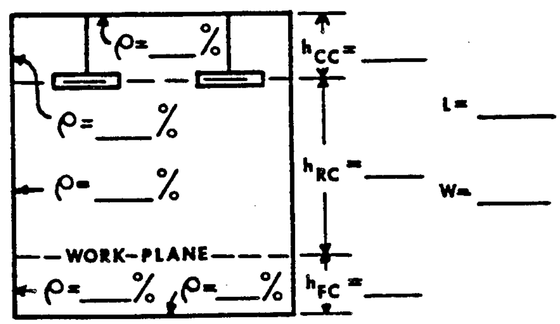
Luminaire data:

Manufacturer: ________________

Catalog number: ________________

SELECTION OF COEFFICIENT OF UTILIZATION

Step 1: Fill in sketch at right.



Step 2: Determine Cavity Ratios from Fig. 9-38, or by formulas.

Room Cavity Ratio, RCR = ________

Ceiling Cavity Ratio, CCR = ________

Floor Cavity Ratio, FCR = ________

Step 3: Obtain Effective Ceiling Cavity Reflectance (ρ_{CC}) from Fig. 9-39. ρ_{CC} = ___

Step 4: Obtain Effective Floor Cavity Reflectance (ρ_{FC}) from Fig. 9-39. ρ_{FC} = ___

Step 5: Obtain Coefficient of Utilization (CU) from Manufacturer's Data. CU = ___

SELECTION OF LIGHT LOSS FACTORS

Nonrecoverable		Recoverable	
Luminaire ambient temperature (See page 9-5.)	___	Room surface dirt depreciation RSDD (See page 9-9.)	___
Voltage to luminaire (See page 9-5.)	___	Lamp lumen depreciation LLD (See page 9-8.)	___
Ballast factor (See page 9-5.)	___	Lamp burnouts factor LBO (See page 9-9.)	___
Luminaire surface depreciation (See page 9-7.)	___	Luminaire dirt depreciation LDD (See page 9-8.)	___

Total light loss factor, LLF (product of individual factors above) = ______

CALCULATIONS

(Average Maintained Illuminance)

$$\text{Number of Luminaires} = \frac{(\text{Illuminance}) \times (\text{Area})}{(\text{Lumens per Luminaire}) \times (\text{CU}) \times (\text{LLF})}$$

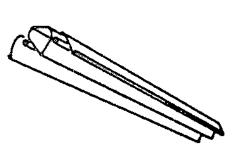
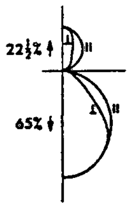
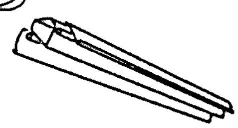
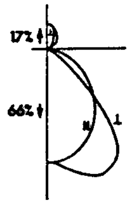
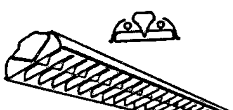
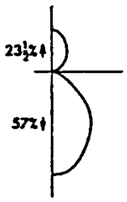
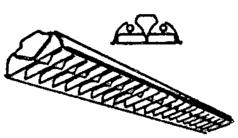
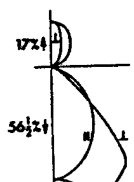
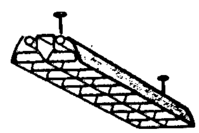
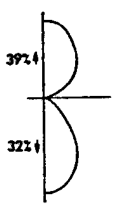
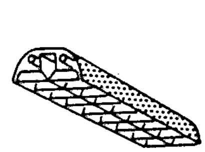
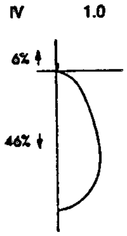
= ______________________________ =

$$\text{Illuminance} = \frac{(\text{Number of Luminaires}) \times (\text{Lumens per Luminaire}) \times (\text{CU}) \times (\text{LLF})}{(\text{Area})}$$

= ______________________________ =

Calculated by: ______________________________ Date: ____________

Fig. 9-62. *Continued* (see page 9-53 for instructions and notes)

Typical Luminaire	Typical Intensity Distribution and Per Cent Lamp Lumens		ρ_{CC} →	80			70			50			30			10			0		ρ_{CC} →
			ρ_W →	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0	WDRC	ρ_W →
	Maint. Cat.	SC	RCR ↓	Coefficients of Utilization for 20 Per Cent Effective Floor Cavity Reflectance (ρ_{FC} = 20)																	RCR ↓
25  	II	1.3	0	.99	.99	.99	.94	.94	.94	.85	.85	.85	.77	.77	.77	.69	.69	.69	.65		
			1	.87	.84	.81	.83	.80	.77	.75	.73	.71	.68	.66	.65	.62	.60	.59	.56	.236	1
			2	.77	.71	.67	.73	.68	.64	.67	.63	.60	.60	.58	.55	.55	.53	.51	.48	.220	2
			3	.68	.62	.56	.65	.59	.54	.59	.55	.51	.54	.50	.47	.49	.46	.44	.41	.203	3
			4	.61	.54	.48	.58	.52	.47	.53	.48	.44	.48	.44	.41	.44	.41	.38	.35	.186	4
			5	.54	.47	.42	.52	.46	.41	.48	.42	.38	.44	.39	.36	.40	.36	.33	.31	.170	5
			6	.49	.42	.37	.47	.40	.36	.43	.38	.34	.40	.35	.32	.36	.33	.30	.27	.157	6
			7	.45	.37	.32	.43	.36	.32	.39	.34	.30	.36	.32	.28	.33	.29	.26	.24	.145	7
			8	.41	.34	.29	.39	.33	.28	.36	.31	.27	.33	.29	.25	.31	.27	.24	.22	.135	8
Porcelain-enameled reflector with			9	.37	.31	.26	.36	.30	.25	.33	.28	.24	.31	.26	.23	.28	.24	.22	.20	.126	9
35°CW shielding			10	.34	.28	.24	.33	.27	.23	.31	.25	.22	.28	.24	.21	.26	.22	.20	.18	.118	10
26  	II	1.5/1.3	0	.95	.95	.95	.91	.91	.91	.83	.83	.83	.76	.76	.76	.69	.69	.69	.66		
			1	.85	.82	.79	.81	.79	.76	.75	.73	.71	.69	.67	.66	.63	.62	.61	.58	.197	1
			2	.75	.71	.67	.72	.68	.65	.67	.63	.61	.62	.59	.57	.57	.55	.53	.51	.194	2
			3	.67	.61	.57	.65	.59	.55	.60	.56	.52	.55	.52	.49	.51	.49	.46	.44	.184	3
			4	.60	.54	.49	.58	.52	.48	.54	.49	.45	.50	.46	.43	.46	.43	.41	.39	.173	4
			5	.54	.47	.43	.52	.46	.42	.49	.43	.40	.45	.41	.38	.42	.39	.36	.34	.162	5
			6	.49	.42	.37	.47	.41	.37	.44	.39	.35	.41	.37	.33	.38	.35	.32	.30	.151	6
			7	.44	.38	.33	.43	.37	.32	.40	.35	.31	.38	.33	.30	.35	.31	.28	.27	.141	7
			8	.40	.34	.29	.39	.33	.29	.37	.31	.28	.34	.30	.27	.32	.28	.26	.24	.132	8
Diffuse aluminum reflector with			9	.37	.31	.26	.36	.30	.26	.34	.29	.25	.32	.27	.24	.30	.26	.23	.21	.124	9
35°CW shielding			10	.34	.28	.24	.33	.27	.23	.31	.26	.23	.29	.25	.22	.28	.24	.21	.19	.117	10
27  	II	1.0	0	.91	.91	.91	.86	.86	.86	.77	.77	.77	.68	.68	.68	.61	.61	.61	.57		
			1	.80	.77	.75	.76	.74	.71	.69	.67	.65	.62	.60	.59	.55	.54	.53	.50	.182	1
			2	.71	.67	.63	.68	.64	.60	.61	.58	.55	.55	.53	.51	.50	.48	.46	.43	.174	2
			3	.63	.58	.53	.60	.55	.51	.55	.51	.47	.50	.46	.44	.45	.42	.40	.38	.163	3
			4	.57	.51	.46	.54	.49	.44	.49	.45	.41	.45	.41	.38	.41	.38	.35	.33	.151	4
			5	.51	.45	.40	.49	.43	.39	.45	.40	.36	.41	.37	.34	.37	.34	.31	.29	.140	5
			6	.46	.40	.35	.44	.38	.34	.41	.36	.32	.37	.33	.30	.34	.30	.28	.26	.130	6
			7	.42	.36	.31	.40	.35	.30	.37	.32	.29	.34	.30	.27	.31	.28	.25	.23	.121	7
			8	.38	.32	.28	.37	.31	.27	.34	.29	.26	.31	.27	.24	.29	.25	.23	.21	.113	8
Porcelain-enameled reflector with			9	.35	.29	.25	.34	.28	.25	.31	.27	.23	.29	.25	.22	.27	.23	.21	.19	.106	9
30°CW × 30°LW shielding			10	.33	.27	.23	.31	.26	.22	.29	.24	.21	.27	.23	.20	.25	.21	.19	.17	.099	10
28  	II	1.5/1.1	0	.83	.83	.83	.79	.79	.79	.72	.72	.72	.65	.65	.65	.59	.59	.59	.56		
			1	.74	.72	.70	.71	.69	.67	.65	.63	.62	.59	.58	.57	.54	.53	.52	.50	.160	1
			2	.66	.62	.59	.64	.60	.57	.58	.56	.53	.54	.51	.49	.49	.47	.46	.44	.158	2
			3	.59	.54	.50	.57	.53	.49	.53	.49	.46	.48	.46	.43	.45	.42	.40	.38	.150	3
			4	.53	.48	.44	.51	.46	.42	.47	.43	.40	.44	.41	.38	.40	.38	.36	.34	.141	4
			5	.48	.42	.38	.46	.41	.37	.43	.39	.35	.40	.36	.33	.37	.34	.32	.30	.132	5
			6	.44	.38	.34	.42	.37	.33	.39	.35	.31	.36	.33	.30	.34	.31	.28	.27	.124	6
			7	.40	.34	.30	.38	.33	.29	.36	.31	.28	.33	.30	.27	.31	.28	.25	.24	.116	7
			8	.36	.31	.27	.35	.30	.26	.33	.28	.25	.31	.27	.24	.29	.25	.23	.21	.109	8
Diffuse aluminum reflector with 35°CW			9	.33	.28	.24	.32	.27	.24	.30	.26	.23	.28	.24	.22	.26	.23	.21	.19	.102	9
× 35°LW shielding			10	.31	.25	.22	.30	.25	.22	.28	.24	.21	.26	.22	.20	.25	.21	.19	.18	.096	10
29  	II	1.1	0	.75	.75	.75	.69	.69	.69	.57	.57	.57	.46	.46	.46	.37	.37	.37	.32		
			1	.66	.64	.62	.61	.59	.57	.51	.50	.48	.42	.41	.40	.33	.33	.32	.28	.094	1
			2	.59	.55	.52	.54	.51	.48	.46	.43	.41	.38	.36	.34	.30	.29	.28	.25	.091	2
			3	.52	.48	.44	.48	.44	.41	.41	.38	.35	.34	.32	.30	.27	.26	.25	.22	.085	3
			4	.47	.42	.38	.43	.39	.35	.37	.33	.31	.31	.28	.26	.25	.23	.22	.19	.079	4
			5	.42	.37	.33	.39	.34	.31	.33	.30	.27	.28	.25	.23	.23	.21	.20	.17	.073	5
			6	.38	.33	.29	.35	.31	.27	.30	.27	.24	.25	.23	.21	.21	.19	.18	.16	.068	6
			7	.35	.29	.26	.32	.28	.24	.28	.24	.21	.23	.21	.19	.19	.17	.16	.14	.063	7
			8	.32	.26	.23	.29	.25	.22	.25	.22	.19	.22	.19	.17	.18	.16	.15	.13	.059	8
Metal or dense diffusing sides with			9	.29	.24	.21	.27	.23	.20	.23	.20	.17	.20	.17	.15	.17	.15	.13	.12	.056	9
45°CW × 45°LW shielding			10	.27	.22	.19	.25	.21	.18	.22	.18	.16	.19	.16	.14	.16	.14	.12	.11	.052	10
30  	IV	1.0	0	.61	.61	.61	.58	.58	.58	.55	.55	.55	.51	.51	.51	.48	.48	.48	.46		
			1	.54	.52	.50	.52	.50	.49	.49	.47	.46	.46	.45	.43	.43	.42	.41	.40	.159	1
			2	.48	.45	.42	.46	.44	.41	.44	.41	.39	.41	.39	.38	.39	.37	.36	.34	.145	2
			3	.43	.39	.36	.42	.38	.35	.39	.36	.34	.37	.35	.33	.35	.33	.31	.30	.132	3
			4	.39	.35	.32	.38	.34	.31	.36	.32	.30	.34	.31	.29	.32	.30	.28	.27	.121	4
			5	.35	.31	.28	.34	.30	.27	.32	.29	.27	.31	.28	.26	.29	.27	.25	.24	.111	5
			6	.32	.28	.25	.31	.27	.25	.30	.26	.24	.28	.25	.23	.27	.25	.23	.22	.102	6
			7	.29	.25	.22	.29	.25	.22	.27	.24	.22	.26	.23	.21	.25	.23	.21	.20	.095	7
			8	.27	.23	.20	.27	.23	.20	.25	.22	.20	.24	.21	.19	.23	.21	.19	.18	.088	8
Same as unit #29 except with top reflec-			9	.25	.21	.19	.25	.21	.18	.24	.20	.18	.23	.20	.18	.22	.19	.17	.16	.083	9
tors			10	.23	.20	.17	.23	.19	.17	.22	.19	.17	.21	.18	.16	.20	.18	.16	.15	.077	10

CHAPTER 12

ELECTRICAL CRITERIA

1. LIGHTING.

a. Design Requirements. The design of interior, exterior, and sports lighting at Army installations will be according to the fundamentals and recommendations of the IES Lighting Handbook (reference 12-1), published by the Illuminating Engineering Society (IES), subject to the modifications and clarifications noted in subparagraphs 1.b. through 1.f., below.

b. Lighting Intensities for Facilities. Maintained lighting intensities will conform to those recommended in the current edition of the IES Lighting Handbook, except as modified in this chapter. The IES intensities were published as minimums for specific tasks. However, the IES intensities will be considered as maximum design levels not to be changed significantly except in areas designed for an integrated air-conditioning and lighting system. The recommended intensities required for the predominant specific visual tasks in an area may be provided by the general illumination for the area. However, maintained general illumination will not exceed 75 footcandles [807 lux] in any area, unless otherwise indicated in this chapter. Where fluorescent general lighting levels exceed 50 footcandles [538 lux] in air-conditioned areas, an integrated air-conditioning and lighting system will be evaluated (see chapter 13), and the lighting fixtures will meet the necessary requirements.

(1) Conservation Requirements. Normally, general illumination levels in administrative areas will not exceed 50 footcandles [538 lux] at work stations, 30 footcandles [323 lux] in work areas, and 10 footcandles [108 lux] in nonworking areas. These illumination levels, in conjunction with energy conservation, will be obtained by the most life cycle cost-effective techniques including, but not limited to, the following:

(a) Multiple switching of multilamp fixtures or multiple switching of fixture groups in large rooms, or both, to permit lights to be turned off at unoccupied work stations and installing two lamps in four-lamp fixtures having integral toggle switches capable of disconnecting one ballast (two lamps) from the supply source.

(b) Time clock or photoelectric control, or both, of general indoor and outdoor lighting.

(c) Multilevel switched ballasts to provide nonuniform general lighting.

(d) More efficient lighting sources, fixtures, lamps, and use of solid-state ballasts.

(e) Grid-type ceilings with the capability of interchanging relocatable panels and lighting fixtures without rewiring. This type of ceiling will provide the flexibility to accommodate changes in functional requirements of the occupants.

(f) Lower wattage lamps (35-watt versus 40-watt fluorescent lamps).

(2) Special Requirements. If an intensity greater than 75 footcandles [807 lux] is required for a particular task, the additional footcandles will be provided by localized (supplementary) lighting. The ratios between general and supplementary illumination will not exceed those recommended by the IES. Supplementary lighting normally will be provided by the user of the facility. However, power for such lighting will be provided by the facility.

(3) Environmental Factors. The finish and color of surrounding surfaces, equipment, and furniture will be selected for reduced glare, increased light use, and acceptable brightness balance. Lighting equipment and layout will be coordinated with other building design features to prevent interferences and to promote a good appearance.

(4) Cross-Reference of DA Facilities to IES Tables. In some instances, the names and functions of facilities used by the Department of the Army are not the same names and functions of similar facilities given in the IES Tables of Recommended Levels of Illumination, IES Lighting Handbook (reference 12-1). For the purpose of comparison, the following cross-references of types of facilities are shown in table 12-1.

TABLE 12-1

DA-IES CROSS-REFERENCE OF FACILITIES

DA Facility Designation - Name or Function	IES Tables Designation - Name or Function
Administrative Areas	Offices, Drafting, Conference, and Accounting Rooms
Chapels	Churches and Synagogues
Classroom Buildings	Schools
Confinement Facilities	Municipal Buildings - Fire and Police
Dining Facilities	Food Service Facilities
Exchange Facilities	Stores
Parking for Military Vehicles (with minor repair areas)	Parking Areas and Service Stations

TABLE 12-1 (continued)

DA-IES CROSS-REFERENCE OF FACILITIES	
DA Facility Designation - Name or Function	IES Tables Designation - Name or Function
Service Clubs	Applicable Areas of Auditoriums, Food Service Facilities, Offices, Schools, and Stores
Unaccompanied Personnel Housing	Hotels
Vehicle Maintenance Facilities	Garages and Service Stations
Warehouses	Storage Rooms or Warehouses

(5) Hangar Illumination. The maintained general illumination level of hangars will not exceed 75 footcandles [807 lux].

(6) Warehouse Illumination. The general illumination level in warehouses will not exceed the values shown in table 12-2 as measured at 4 ft [1.2 m] above the finished floor.

TABLE 12-2

ILLUMINATION IN WAREHOUSES

Types of Warehousing	Intensity	
	Footcandles	[Lux]
Active-Bulk [1]	10	108
Bin [2]	5	54
Inactive	5	54
Mechanical Material Handling:		
Accumulation Conveyor Lines (Unmanned)	10	108
Control Centers and Stations	30	323
Loading and Unloading Areas	20	215
Rack	20	215

[1] Main aisles may be lighted to 15 footcandles [161 lux].

2 Specialized lighting designed to illuminate the bins, as required, will be provided by the building user.

(7) Exterior Sports Illumination. Outdoor sports lighting will conform to the classifications stated in the IES Lighting Handbook (reference 12-1), as shown in table 12-3.

TABLE 12-3

IES SPORTS CLASSIFICATIONS

Sports Activity	IES Classification
Baseball	Municipal and Semiprofessional
Football	Class III or IV
Softball	Industrial League
Other	Recreational

(8) Illumination in Functional Areas of Other Facilities. The general illumination levels in functional areas of other facilities will not exceed the intensities shown in table 12-4.

TABLE 12-4

ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES

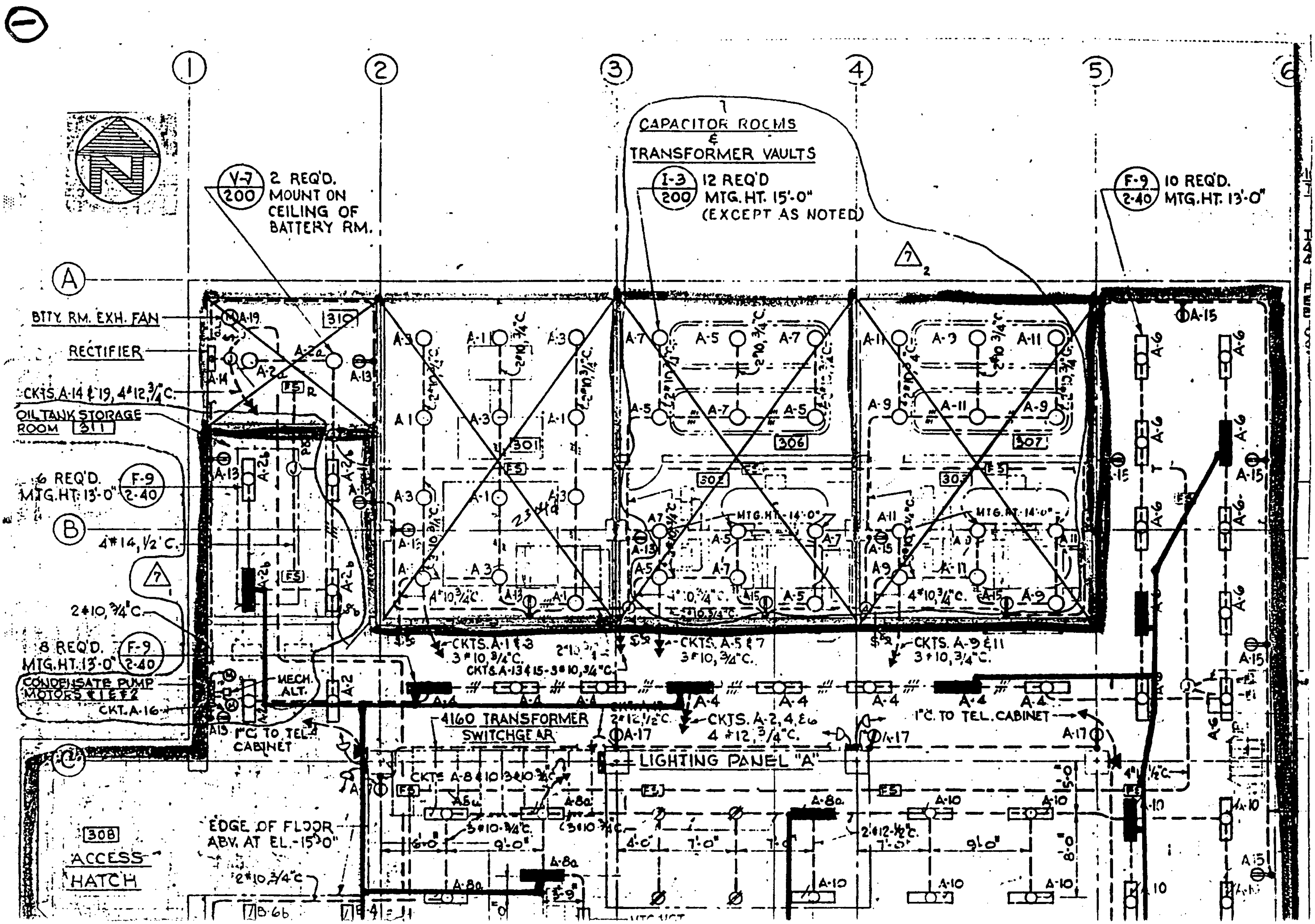
Functional Areas	Intensity	
	Footcandles	[Lux]
Accounting Rooms	75	807
Auditoriums	20	215
Cafeterias	25	269
Computer Rooms	50	538
Conference Rooms	30	323
Corridors	10	108
Drafting Rooms	75	807
Elevator Machine Rooms	15	161

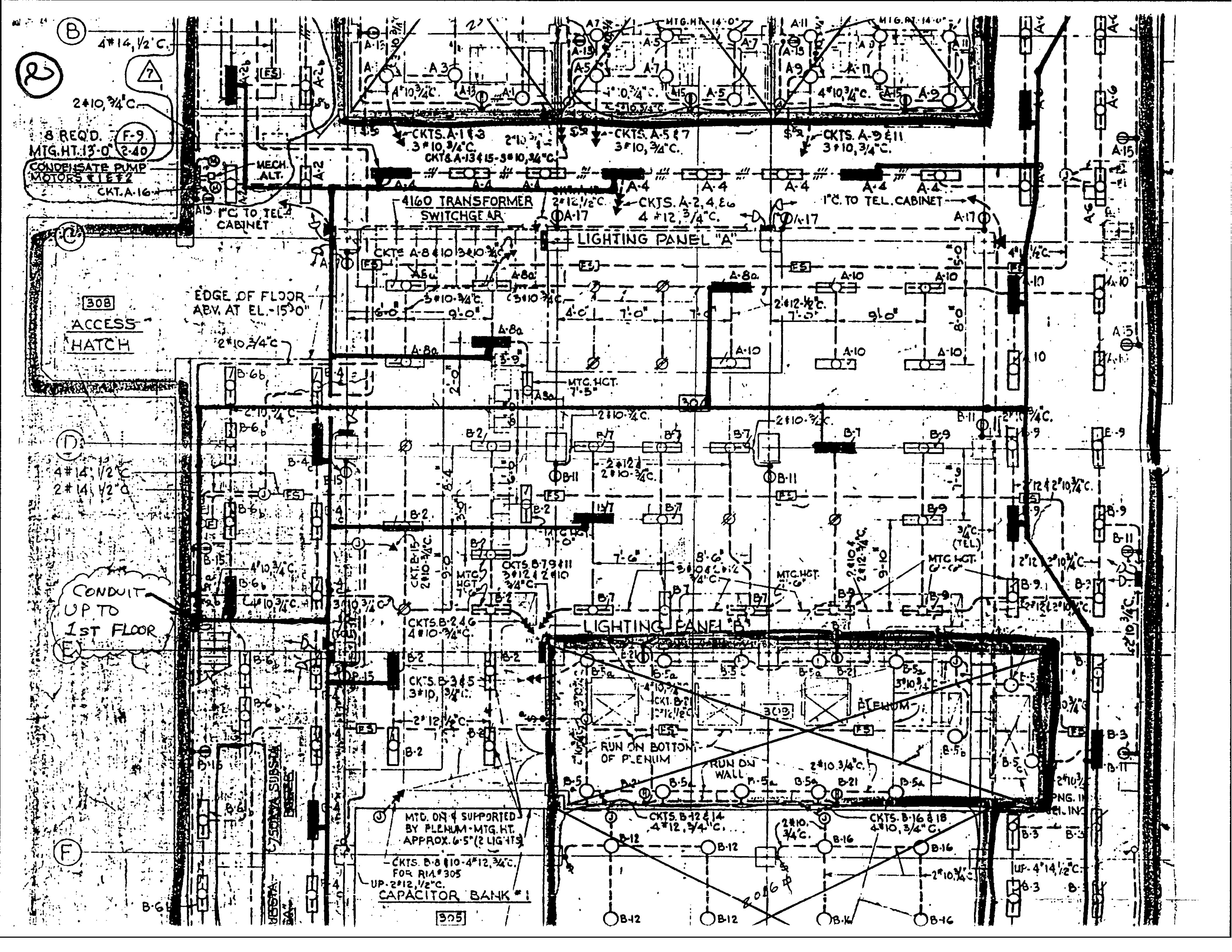
TABLE 12-4 (continued)

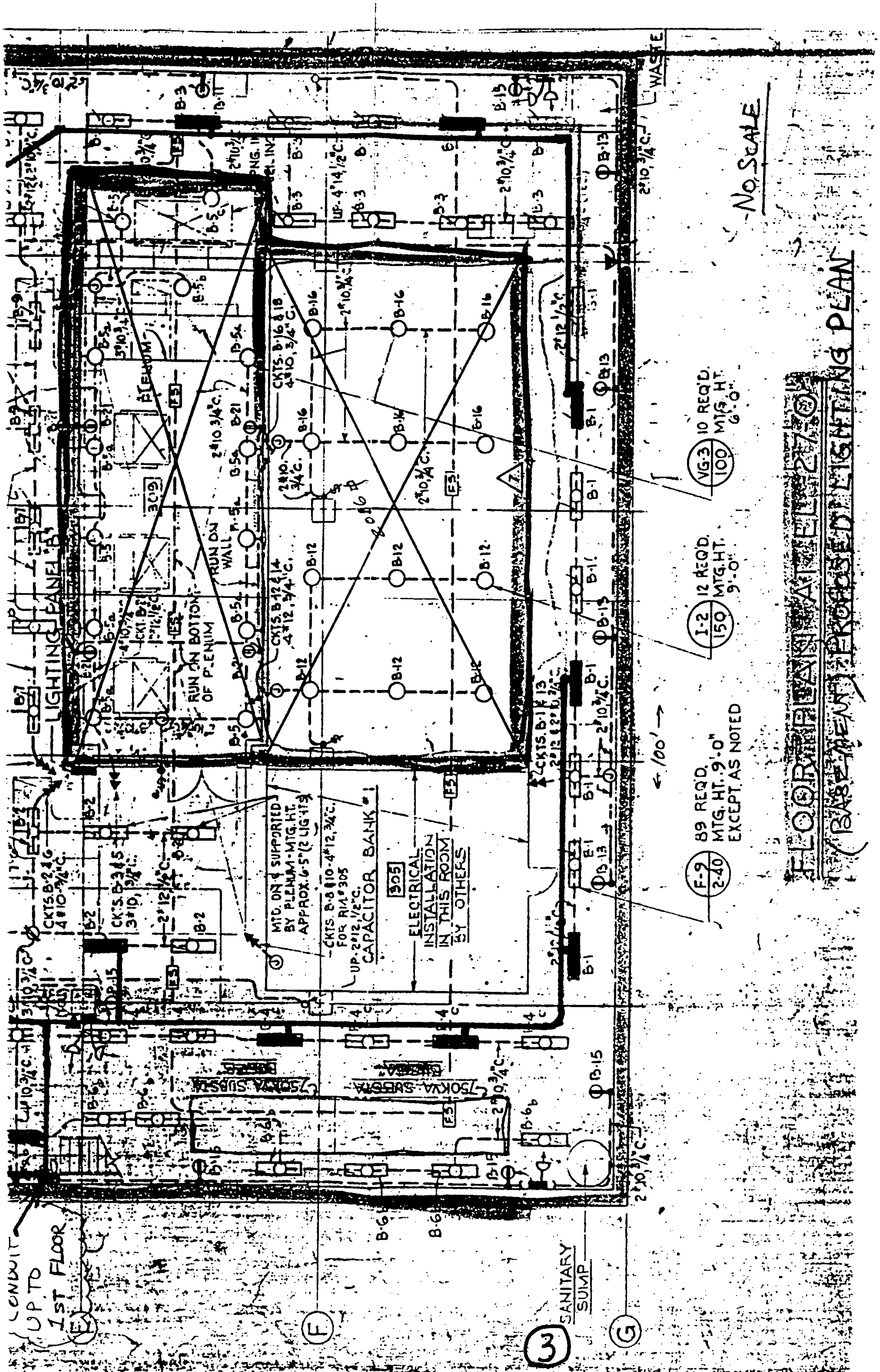
ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES		
	Intensity	
Functional Areas	Footcandles	[Lux]
Emergency Generator Rooms	15	161
Garage Driving and Parking Areas	5	54
Garage Entrances	30	323
General Office Space	50	538
Janitors' Closets	5	54
Kitchens	70	753
Lobbies	15	161
Lounges	15	161
Mechanical and Electrical Equipment Rooms	15	161
Parking Lots	0.5	5
Stairways	20	215
Storage Rooms	5	54
Switchgear Rooms	15	161
Toilet Facilities	20	215
Transformer Vaults	15	161

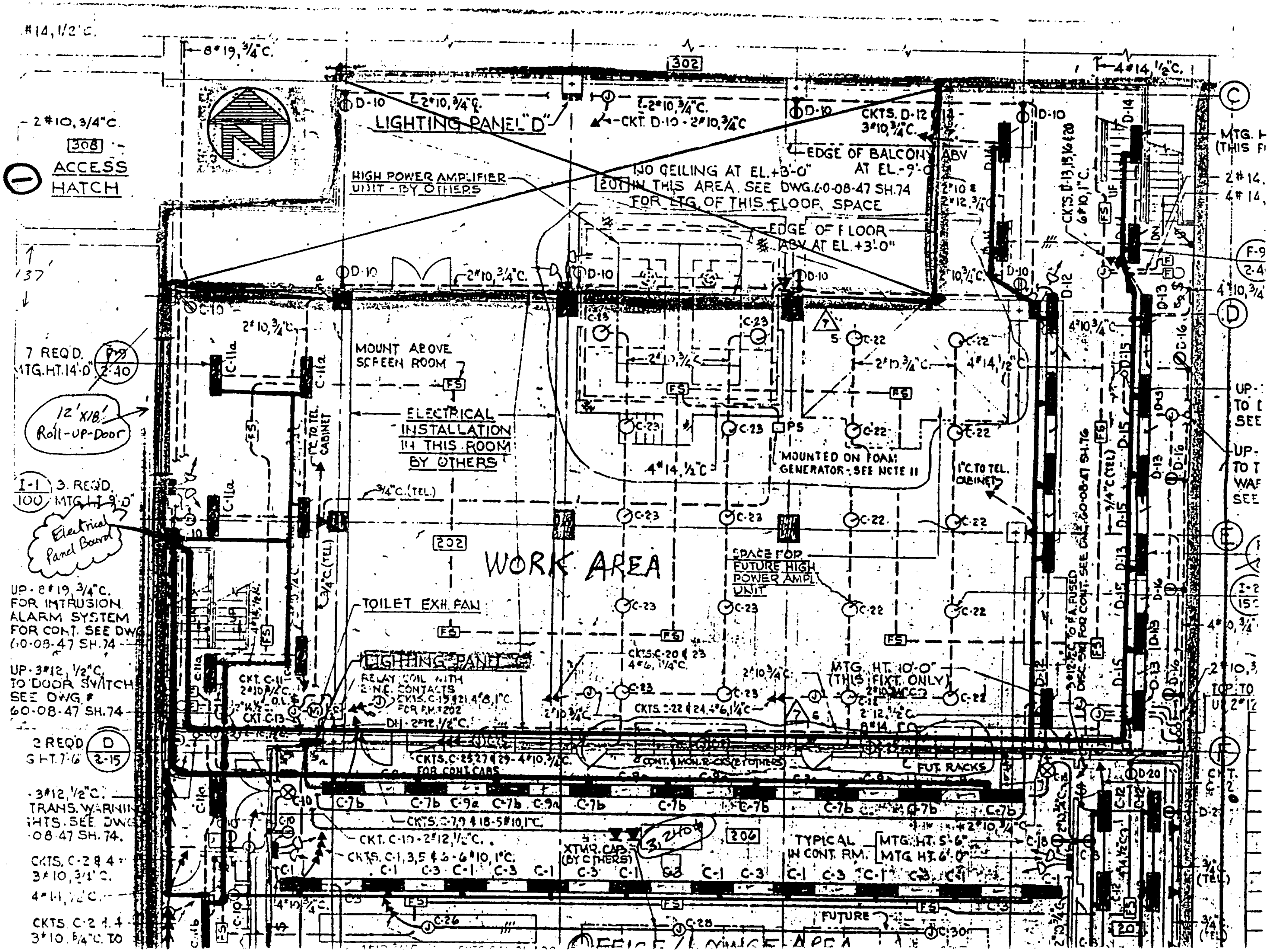
(9) Special Facility Illumination. When fluorescent or high-intensity discharge lighting is prohibited and the required intensity exceeds 30 footcandles [323 lux], the general lighting system should be designed for incandescent lighting of 30 footcandles [323 lux] with supplementary incandescent lighting for specific tasks where required.

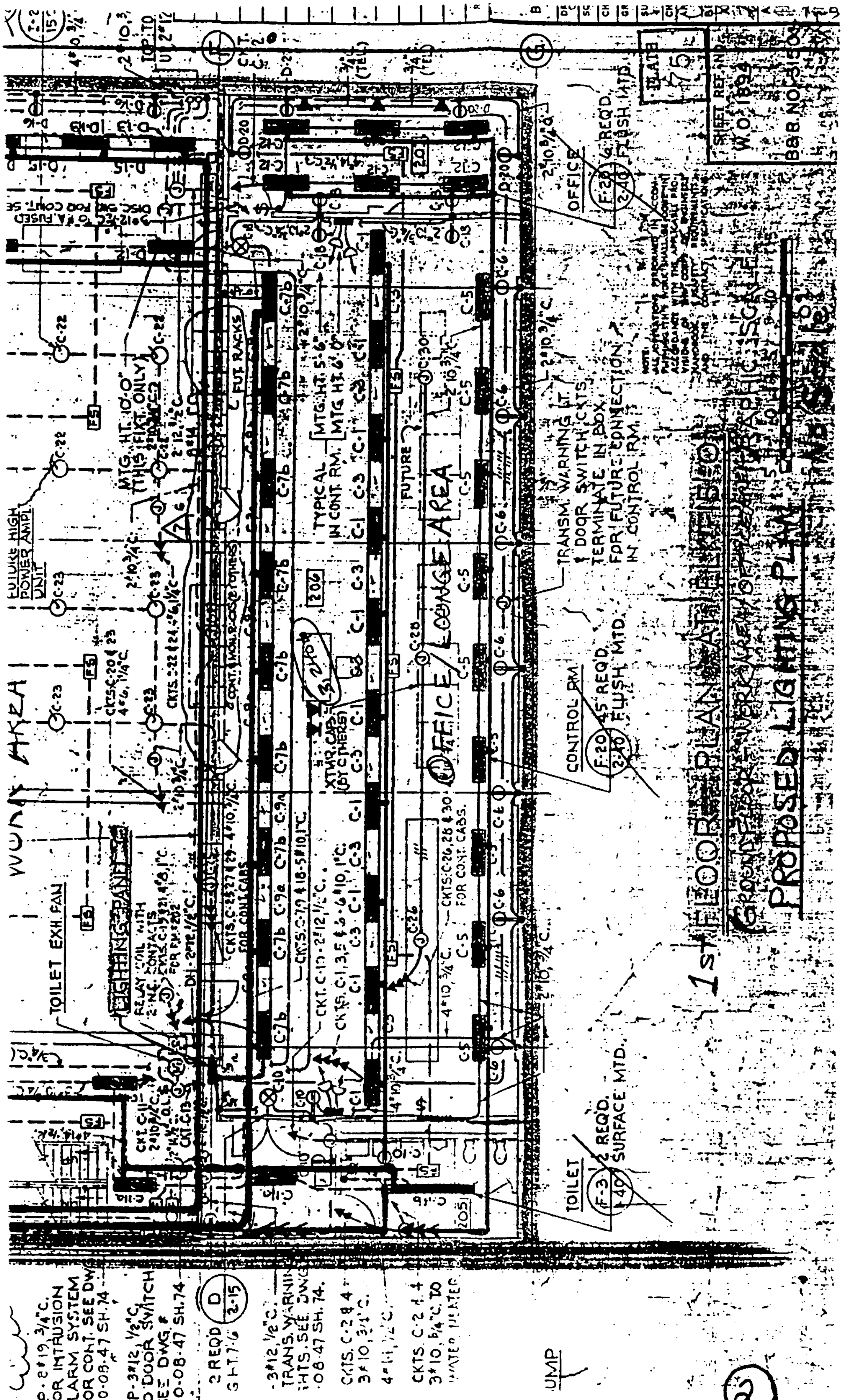
c. Emergency Lighting. Emergency lighting systems will be provided in accordance with the requirements of NFPA 101 (reference 12-2). Provisions will be made to transfer the exit lighting system to a standby generating source in facilities with standby electric power systems. Emergency supplementary incandescent or fluorescent lighting of one footcandle [10.76

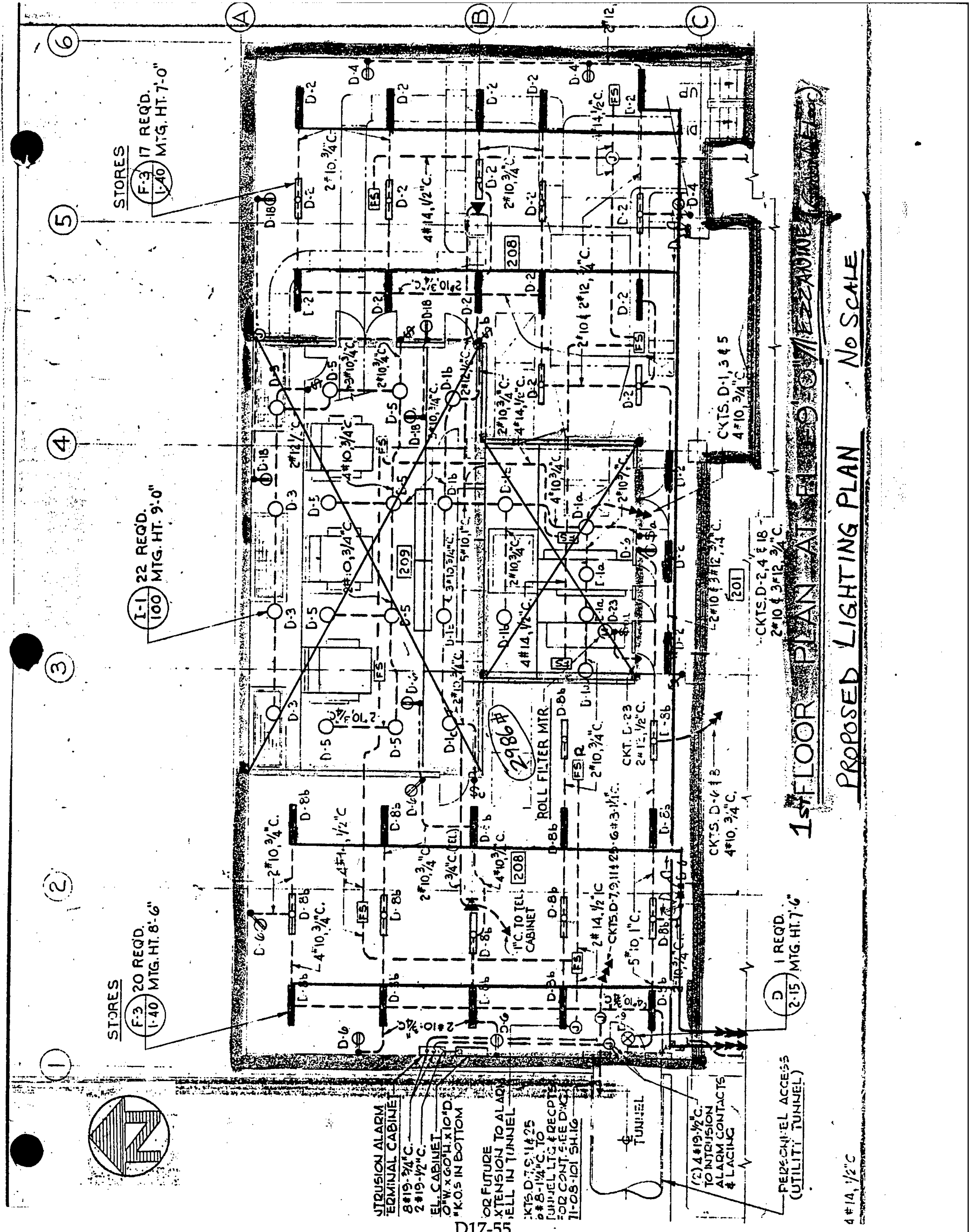

CAPACITOR ROOMS
&
TRANSFORMER VAULTS
I-3
200
12 REQ'D
MTG. HT. 15'-0"
(EXCEPT AS NOTED)
V-7
200
2 REQ'D.
MOUNT ON
CEILING OF
BATTERY RM.
F-9
2-40
10 REQ'D.
MTG. HT. 13'-0"
BTTY. RM. EXH. FAN
RECTIFIER
CKTS. A-14 & 19, 4#12, 3/4"C.
OIL TANK STORAGE
ROOM 311
6 REQ'D.
MTG. HT. 13'-0"
4#14, 1/2"C.
2#10, 3/4"C.
8 REQ'D.
MTG. HT. 13'-0"
CONDENSATE PUMP
MOTORS #1 & #2
CKT. A-16
MECH.
ALT.
1"C. TO TEL.
CABINET
CKTS. A-1 & 3
3#10, 3/4"C.
CKTS. A-13 & 15-3#10, 3/4"C.
CKTS. A-5 & 7
3#10, 3/4"C.
CKTS. A-9 & 11
3#10, 3/4"C.
4160 TRANSFORMER
SWITCHGEAR
CKTS. A-2, 4, & 6
4#12, 3/4"C.
1"C. TO TEL. CABINET
LIGHTING PANEL "A"
MTG. HT. 14'-0"
EDGE OF FLOOR
ABV. AT EL. -15'-0"
308
ACCESS
HATCH
2#10, 3/4"C.
310
301
306
307


4#14, 1/2"C.
2#10, 3/4"C.
8 REQ'D.
MTG. HT. 13'-0"
F-9
2-40
CONDENSATE PUMP MOTORS #1 & 2
CKT. A-16
MECH. ALT.
1"C TO TEL. CABINET
308
ACCESS HATCH
EDGE OF FLOOR ABV. AT EL.-15'-0"
CKTS. A-1 & 3
3#10, 3/4"C.
CKTS. A-13 & 15-3#10, 3/4"C.
CKTS. A-5 & 7
3#10, 3/4"C.
CKTS. A-9 & 11
3#10, 3/4"C.
MTG. HT. 14'-0"
4160 TRANSFORMER SWITCHGEAR
CKTS. A-2, 4, & 6
4#12, 3/4"C.
1"C. TO TEL. CABINET
LIGHTING PANEL "A"
CKTS. A-8 & 10 3#10-3/4"C.
MTG. HGT. 7'-5"
2#12-1/2"C.
4#14, 1/2"C
2#14, 1/2"C
CONDUIT UP TO 1ST FLOOR
CKTS. B-7, 9 & 11
CKTS. B-2, 4, 6
4#10-3/4"C.
LIGHTING PANEL "B"
CKTS. B-3 & 5
3#10, 3/4"C.
MTG. HGT.
3/4"C. (TEL)
RUN ON BOTTOM OF PLENUM
RUN ON WALL
PLENUM
309
CKT. B-21
MTD. ON & SUPPORTED BY PLENUM-MTG. HT. APPROX. 6-5" (2 LIGHTS)
CKTS. B-8 & 10-4#12, 3/4"C. FOR RM# 305
UP-2#12, 1/2"C.
CAPACITOR BANK #1
305
CKTS. B-12 & 14
4#12, 3/4"C.
CKTS. B-16 & 18
4#10, 3/4"C.
UP-4#14, 1/2"C.
750KVA SUBSTA.

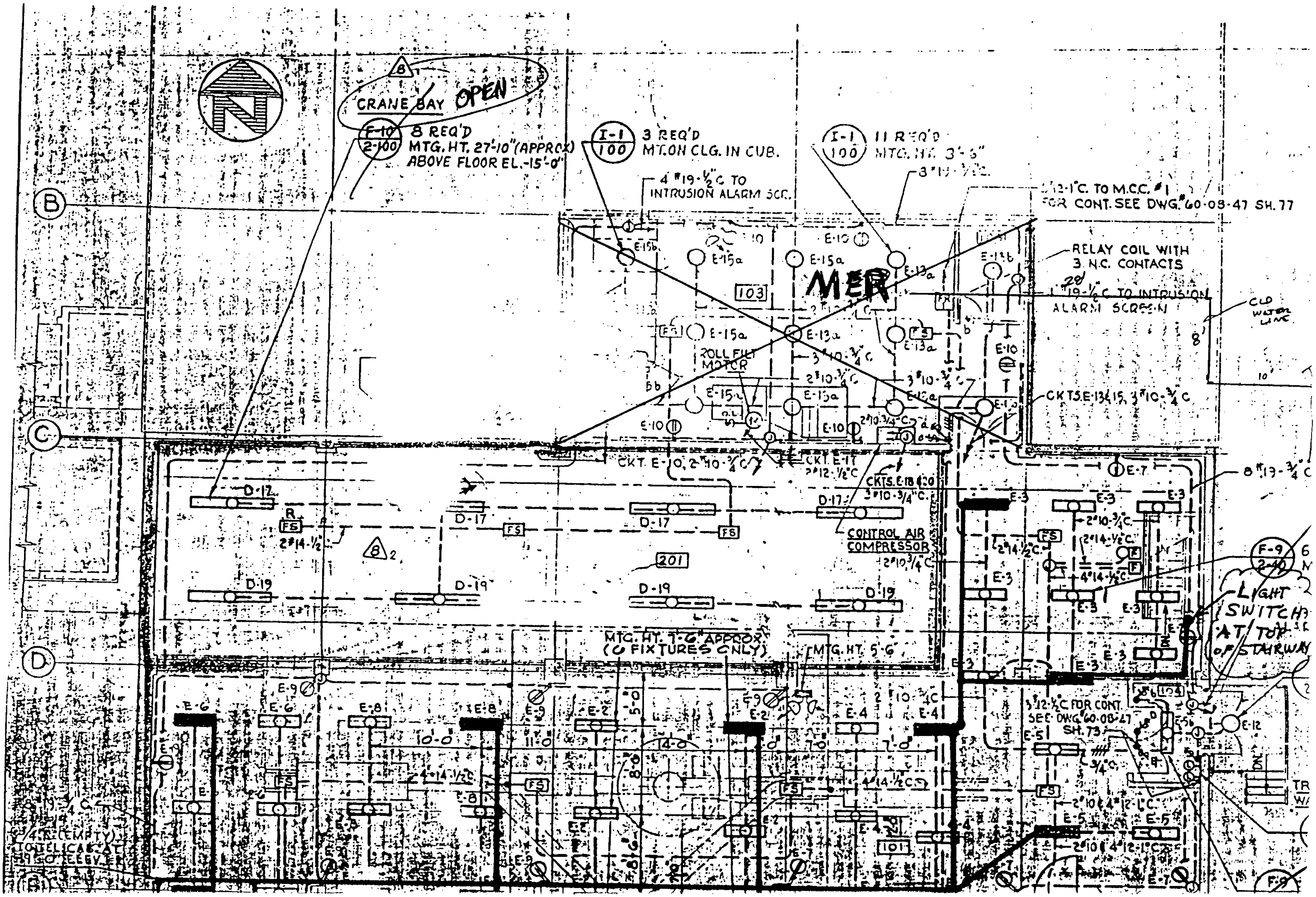

FLOOR PLAN AT EL. 27'-0"
(BASEMENT) PROPOSED LIGHTING PLAN
NO SCALE
LIGHTING PANEL B
CAPACITOR BANK #1
305
ELECTRICAL INSTALLATION IN THIS ROOM BY OTHERS
MTG. ON & SUPPORTED BY PLENUM-MTG. HT. APPROX. 6'-5" (2 LIG'TS)
RUN ON BOTTOM OF PLENUM
RUN ON WALL
PLENUM
89 REQ'D. MTG. HT. 9'-0" EXCEPT AS NOTED
12 REQ'D. MTG. HT. 9'-0"
10 REQ'D. MTG. HT. 6'-0"
750KVA SUBSTA
SANITARY SUMP
WASTE
CONDUIT UP TO 1ST FLOOR


#14, 1/2"C.
8#19, 3/4"C.
302
2#10, 3/4"C.
308
ACCESS
HATCH
LIGHTING PANEL "D"
CKT. D-10 - 2#10, 3/4"C
CKTS. D-12 & 14 - 3#10, 3/4"C.
EDGE OF BALCONY ABV AT EL.-9'-0"
HIGH POWER AMPLIFIER UNIT - BY OTHERS
NO CEILING AT EL.+3'-0" IN THIS AREA. SEE DWG. 60-08-47 SH.74 FOR LTG. OF THIS FLOOR SPACE
201
EDGE OF FLOOR ABV AT EL.+3'-0"
MTG. HT. 14'-0"
7 REQD.
12' X 18' Roll-up-Door
MOUNT ABOVE SCREEN ROOM
ELECTRICAL INSTALLATION IN THIS ROOM BY OTHERS
MOUNTED ON FOAM GENERATOR - SEE NOTE 11
1"C. TO TEL. CABINET
3 REQD. MTG. HT. 9'-0"
Electrical Panel Board
202
WORK AREA
SPACE FOR FUTURE HIGH POWER AMPL UNIT
TOILET EXH. FAN
UP - 8#19, 3/4"C. FOR INTRUSION ALARM SYSTEM FOR CONT. SEE DWG. 60-08-47 SH.74
UP - 3#12, 1/2"C. TO DOOR SWITCH SEE DWG. # 60-08-47 SH.74
LIGHTING PANEL "C"
RELAY COIL WITH 2 N.C. CONTACTS
CKTS. C-20 & 23 4#6, 1 1/4"C.
CKTS. C-22 & 24 4#6, 1 1/4"C.
MTG. HT. 10'-0" (THIS FIXT. ONLY)
2 REQD. MTG. HT. 7'-6"
CKTS. C-25, 27 & 29 - 4#10, 3/4"C. FOR CONT. CABS.
CONT. & MON. RACKS (BY OTHERS)
FUT. RACKS
3#12, 1/2"C. TRANS. WARNING LIGHTS. SEE DWG. 60-08-47 SH. 74.
CKTS. C-7, 9 & 18 - 5#10, 1"C.
CKT. C-10 - 2#12, 1/2"C.
CKTS. C-1, 3, 5 & 6 - 6#10, 1"C.
XTMR. CAB. (BY OTHERS)
206
TYPICAL IN CONT. RM.
MTG. HT. 5'-6"
MTG. HT. 6'-0"
CKTS. C-2 & 4 - 3#10, 3/4"C.
FUTURE
3#12, 1/2"C. TO F.A. FUSED DISC. SW. FOR CONT. SEE DWG. 60-08-47 SH.76
UP - TO TEL. WAF. SEE

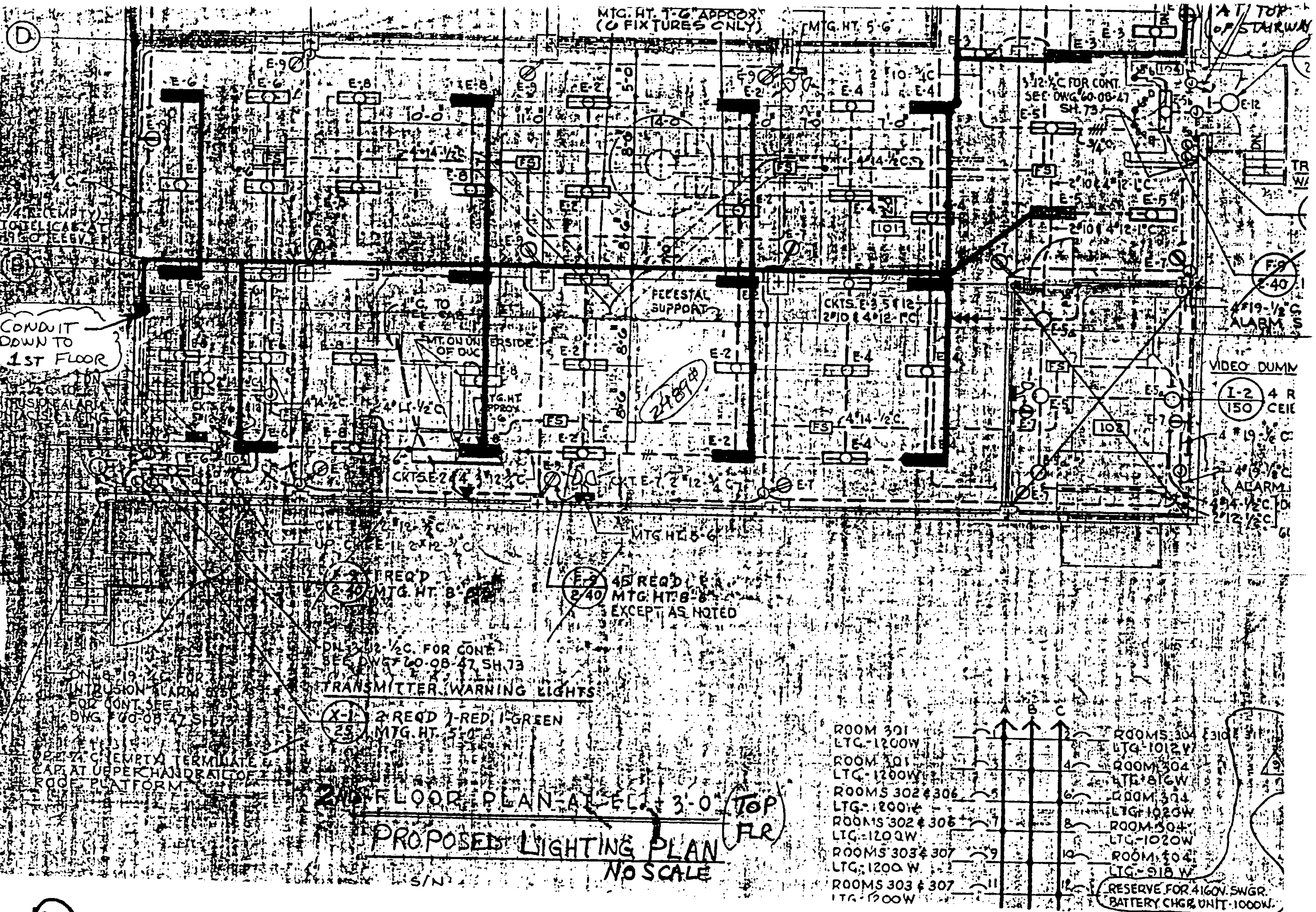

1st FLOOR PLAN
PROPOSED LIGHTING PLAN
NO SCALE
OFFICE/LOUNGE AREA
CONTROL RM.
TOILET
OFFICE
WORK AREA
TOILET EXH. FAN
LIGHTING PANEL
FUT. RACKS
FUTURE HIGH POWER AMPL UNIT
TRANSM. WARNING LT. & DOOR SWITCH CKTS. TERMINATE IN BOX FOR FUTURE CONNECTION IN CONTROL RM.
XTMR. CAP. (BY OTHERS)
TYPICAL IN CONT. RM.
F-20 45 REQD. FLUSH MTD.
F-20 6 REQD. FLUSH MTD.
F-3 2 REQD. SURFACE MTD.
MTG. HT. 10'-0" (THIS FIXT. ONLY)
UP-2#19, 3/4"C. FOR INTRUSION ALARM SYSTEM FOR CONT. SEE DWG. 60-08-47 SH.74
UP-3#12, 1/2"C. TO DOOR SWITCH SEE DWG. 60-08-47 SH.74
CKTS. C-1,3,5 & 6-6#10, 1"C.
CKTS. C-26,28 & 30 FOR CONT. CABS.
205
206
2


1st FLOOR PLAN AT
PROPOSED LIGHTING PLAN
NO SCALE
STORES
F-3 1-40
17 REQ'D. MTG. HT. 7'-0"
I-1 100
22 REQ'D. MTG. HT. 9'-0"
STORES
F-3 1-40
20 REQ'D. MTG. HT. 8'-6"
D 2-15
1 REQ'D. MTG. HT. 7'-6"
208
209
201
ROLL FILTER MTR.
2986#
CKTS. D-1, 3 & 5 4#10, 3/4"C.
CKTS. D-2, 4 & 18 2#10 & 3#12, 3/4"C.
CKTS. D-6 & 8 4#10, 3/4"C.
1"C. TO TEL. CABINET
TUNNEL
PERSONNEL ACCESS (UTILITY TUNNEL)
4#14, 1/2"C

①



CRANE BAY OPEN
F-10 2-100 8 REQ'D
MTG. HT. 27'-10" (APPROX) ABOVE FLOOR EL.-15'-0"
I-1 100 3 REQ'D
MT. ON CLG. IN CUB.
I-1 100 11 REQ'D
4 #19-½"C TO INTRUSION ALARM SCR.
FOR CONT. SEE DWG. #60-08-47 SH. 77
RELAY COIL WITH
3 N.C. CONTACTS
ALARM SCREEN
CLD WATER LINE
MER
103
ROLL FILT MOTOR
CKTS E-13&15, 3#10-¾"C
CKT. E-10, 2#10-¾"C
CKT. E-17
CKTS. E-18 & 20
CONTROL AIR COMPRESSOR
8#13-¾"C
201
MTG. HT. 7'-6" APPROX (6 FIXTURES ONLY)
MTG. HT. 5'-6"
LIGHT SWITCH AT TOP OF STAIRWAY
SEE DWG. 60-08-47 SH. 73
101


2ND FLOOR PLAN AT EL. + 3'-0" TOP FLR
PROPOSED LIGHTING PLAN
NO SCALE
MTG. HT. 1'-6" APPROX. (6 FIXTURES ONLY)
MTG. HT. 5'-6"
AT TOP OF STAIRWAY
CONDUIT DOWN TO 1ST FLOOR
PEDESTAL SUPPORT
CKTS. E-3, 5 & 12
2#10 & 4#12-1"C.
3-1/2"C. FOR CONT. SEE DWG. 60-08-47 SH. 73
MT. ON UNDERSIDE OF DUCT
CKTS. E-2 & 4 3-1/2"C.
CKT. E-7, 2#12-3/4"C.
MTG. HT. 5'-6"
VIDEO DUMMY
ALARM
45 REQ'D
MTG. HT. 8'-6"
EXCEPT AS NOTED
MTG. HT. 8'-0"
DN. 3-1/2"C. FOR CONT.
SEE DWG. 60-08-47, SH. 73
TRANSMITTER WARNING LIGHTS
2 REQ'D 1-RED 1-GREEN
MTG. HT. 5'-0"
INTRUSION ALARM
FOR CONT. SEE DWG. 60-08-47 SH. 73
ROOF PLATFORM
ROOM 301
LTG.-1200W
ROOM 301
LTG.-1200W
ROOMS 302 & 306
LTG.-1200W
ROOMS 302 & 306
LTG.-1200W
ROOMS 303 & 307
LTG.-1200 W
ROOMS 303 & 307
LTG.-1200W
ROOMS 304 & 310
LTG.-1012 W
ROOM 304
LTG.-816W
ROOM 304
LTG.-1020W
ROOM 304
LTG.-1020W
ROOM 304
LTG.-918 W
RESERVE FOR 4160V. SWGR. BATTERY CHGR. UNIT-1000W.
A
B
C
101
102
103
F-9
2/40
I-2
150
X-1
25
E-2
E-3
E-4
E-5
E-6
E-7
E-8
E-9
E-12

D17-56

2

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 24072 - MOD. CONFIG. (ECOs LIGHTING; SETBACK T-STAT) FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/22/92 ECONOMIC LIFE: 15 PREPARED BY: A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=		$13,355	
B. SIOH COST	(5.5% of 1A) =		$735	
C. DESIGN COST	(6.0% of 1A) =		$801	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$14,890	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		------>	$14,890

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	864	$5,595	10.79	$60,368	
B. DIST		0	$0	11.57	$0	
C. PROPANE	$6.71	22	$146	12.38	$1,811	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		886	5,741.1		------>	$62,179

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELECT. DEMAND SAVINGS)	=		$4,310	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$45,982	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$45,982
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$20,519	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	5.55	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/15)) =	$10,051
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$108,161
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	7.26
7 SIMPLE PAYBACK (SPB)	(1F/4) =	1.48

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 24072 – SETBACK/SETUP THERMOSTAT (MOD. CONFIG.)			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/18/92	ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST		=	$2,016	
B. SIOH COST	(5.5% of 1A)	=	$111	
C. DESIGN COST	(6.0% of 1A)	=	$121	
D. ENERGY CREDIT	(1A + 1B + 1C)	=	$2,248	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D – 1E)	=	————>	$2,248

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	129	$834	10.79	$8,996	
B. DIST		0	$0	11.57	$0	
C. PROPANE	$6.71	356	$2,389	12.38	$29,581	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		485	3,223.1		————>	$38,577

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELECT. DEMAND SAVINGS)	=		($683)
1 DISCOUNT FACTOR	(From Table A-2) =	10.67	
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		($7,282)

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		($7,282)
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$12,730	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =		
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/15)) =	$2,541
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$31,295
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	13.92
7 SIMPLE PAYBACK (SPB)	(1F/4) =	0.88

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: 24072 – ENERGY EFFICIENT LIGHTING (MOD. CONFIG.)   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/17/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$11,338	
B. SIOH COST	(5.5% of 1A) =	$624	
C. DESIGN COST	(6.0% of 1A) =	$680	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$12,642	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =	———>	$12,642

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	674	$4,365	15.23	$66,480	
B. DIST		0	$0	17.28	$0	
C. PROPANE	$6.71	(148)	($990)	19.64	($19,438)	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		527	3,375.3		———>	$47,042

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS)	=		$4,290	
1 DISCOUNT FACTOR	(From Table A–2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$62,977	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$62,977
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$15,524	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	4.95	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$7,665
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$110,019
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	8.70
7 SIMPLE PAYBACK (SPB)	(1F/4) =	1.65

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO'S FOR MODIFIED CONFIGURATION – BLDG. 24072

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost Unit (4)	Material Cost Total (5)	Labor Costs Manhours Mandays (6)	Labor Costs Average Rate (7)	Labor Costs Total (8)	Other Direct Costs (9)	Line Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	234	2.19	512.46	0.09	27.60	568.34		$1,080.80
	ENERGY EFFICIENT BALLASTS	EA	117	14.06	1645.02	0.85	27.60	2748.05		$4,393.07
	LIGHTING BRANCH CIRCUITS	LF	1988	1.06	2104.74	0.07	27.60	3588.97		$5,693.71
	LIGHTING SWITCHES	EA	12	6.06	72.72	0.30	27.60	98.04		$170.76
	LIGHTING PANEL BOARD	EA	1	317.2	317.20	7.00	27.60	193.20		$510.40
	TOTAL									$11,338.33
2	MODIFY CONTROLS – INSTALL SETBACK/SETUP THERMOSTAT									
	SETBACK/SETUP THERMOSTAT	EA	1	108.6	108.6	1.00	27.63	27.63		$136.26
	2" CONTROL VALVE – STEAM	EA	1	494.0	494.0	2.00	35.81	71.62		$565.62
	3" CONTROL VALVE – CHILLED WATER	EA	1	1056.0	1056.0	4.00	35.81	143.24		$1,199.24
	PRESSURE/ELECTRIC SWITCH	EA	1	87.5	87.5	1.00	27.63	27.63		$115.13
	TOTAL									$2,016.25
	TOTAL FOR MODIFIED CONFIGURATION									$13,354.58

Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25% overhead & profit, Labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 (Overhead & Profit included); Richardson Cost Estimating Guide, 1992

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**              by           **
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2,3 - SYNG (MODIFIED BASELINE)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 21:38: 2 6/16/92
Dataset Name: 24072M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	16,039	38	1,979	11
Feb	14,146	38	1,560	11
March	16,255	38	689	9
April	12,884	35	0	4
May	16,583	48	0	0
June	20,470	56	0	0
July	22,596	56	0	0
Aug	21,054	56	0	0
Sept	15,842	50	0	0
Oct	13,478	31	0	0
Nov	14,719	38	750	9
Dec	15,458	38	1,394	10
Total	199,524	56	6,372	11

$\sum$ monthly kW = 522

Building Energy Consumption = 37,076 (Btu/Sq Ft/Year)
Source Energy Consumption = 37,630 (Btu/Sq Ft/Year)

Floor Area = 35,555 (Sq Ft)

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**                                                                          **
**              T R A C E    6 0 0    A N A L Y S I S                       **
**                                                                          **
**              by                **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2,3,4 - SYNG (ENERGY EFFICIENT LIGHTING)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 8:24:58 6/18/92
Dataset Name: 24072M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	31,742	53	1,743	10
Feb	28,369	53	1,313	11
March	32,452	53	309	9
April	28,558	47	0	2
May	33,258	67	0	0
June	38,222	77	0	0
July	41,646	80	0	0
Aug	39,398	76	0	0
Sept	31,905	67	0	0
Oct	29,610	63	0	0
Nov	30,826	53	399	9
Dec	31,061	53	1,132	10
Total	397,046	80	4,897	11

Σ monthly kW = 742

Building Energy Consumption = 51,887 (Btu/Sq Ft/Year)
Source Energy Consumption = 52,313 (Btu/Sq Ft/Year)

Floor Area = 35,555 (Sq Ft)

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**                                                                         **
**                T R A C E   6 0 0   A N A L Y S I S                      **
**                                                                         **
**                by            **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2(3)- SYNG (SETBACK-SETUP T-STAT/MODIFY CONTROLS)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 23:10:43 6/16/92
Dataset Name: 24072M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

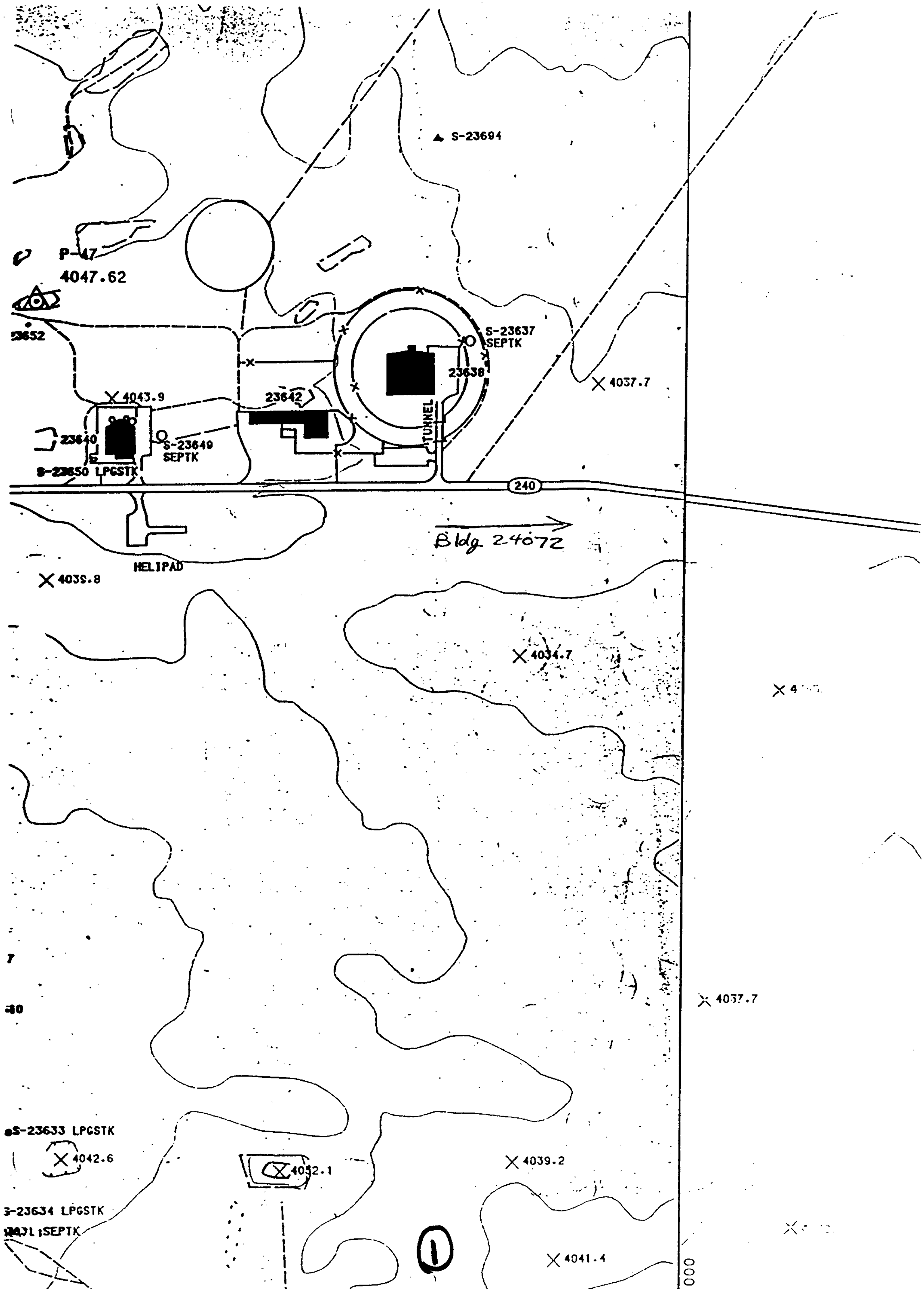
----------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N -----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)				
Jan	17,904	38	3,206	7				
Feb	16,251	38	2,455	6				
March	18,837	38	908	3ril	12,884	35	0	0
May	21,316	48	0	0				
June	25,530	56	0	0				
July	28,325	57	0	0				
Aug	26,228	56	0	0				
Sept	20,258	49	0	0				
Oct	13,477	31	0	0				
Nov	17,992	38	1,031	4				
Dec	18,249	38	2,333	5				
Total	237,250	57	9,933	7				

Building Energy Consumption = 50,712 (Btu/Sq Ft/Year)   Floor Area = 35,555 (Sq Ft)
Source Energy Consumption = 51,576 (Btu/Sq Ft/Year)

Σ monthly KW = 487

TAB 18 TABLE OF CONTENTS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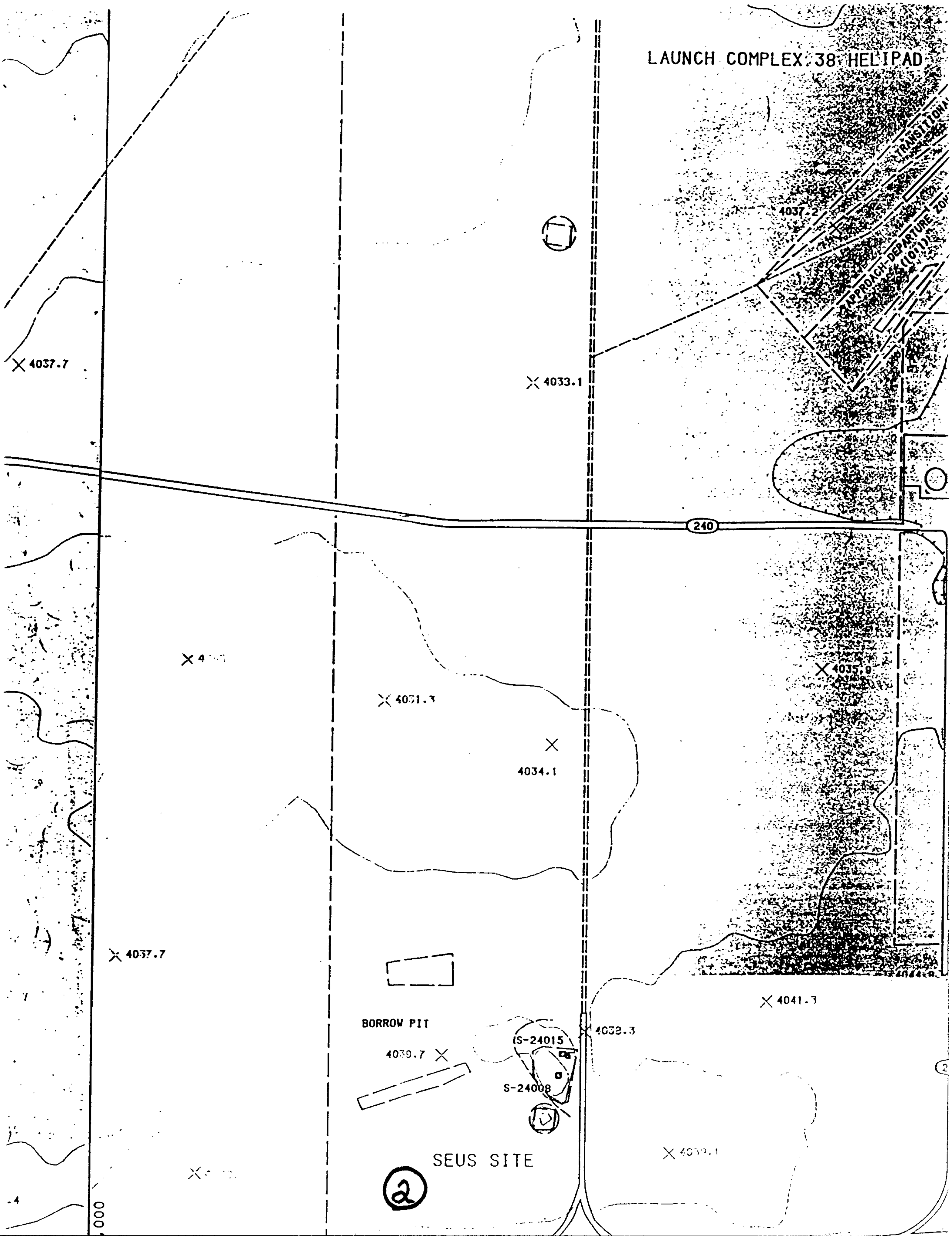
23652
S-23637
SEPTK
23638
4037.7
4043.9
23642
TUNNEL
23640
S-23649
SEPTK
S-23650 LPGSTK
240
Bldg. 24072
HELIPAD
4039.8
4034.7
4037.7
S-23633 LPGSTK
4042.6
4052.1
4039.2
S-23634 LPGSTK
SEPTK
4041.4
1



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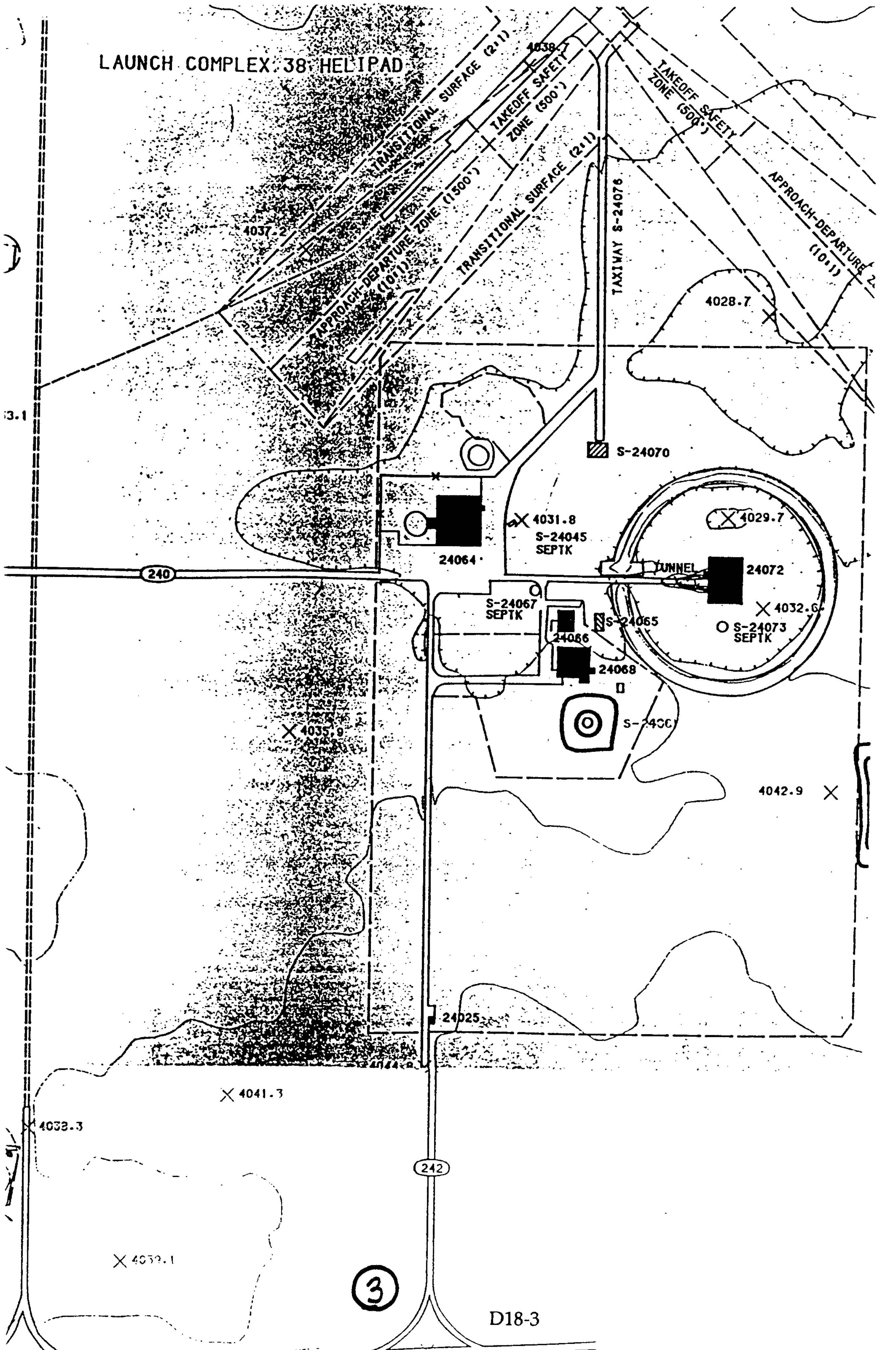
4037.2
4037.7
4033.1
240
4031.3
4034.1
4035.9
4037.7
4041.3
BORROW PIT
4038.3
S-24015
4039.7
S-24008
SEUS SITE
2



LAUNCH COMPLEX 38 HELIPAD
TRANSITIONAL SURFACE (2:1)
TAKEOFF SAFETY ZONE (500')
APPROACH-DEPARTURE ZONE (1500') (10:1)
TRANSITIONAL SURFACE (2:1)
TAXIWAY S-24076
TAKEOFF SAFETY ZONE (500')
APPROACH-DEPARTURE (10:1)
4037.2
4028.7
S-24070
4031.8
S-24045
SEPTK
24064
4029.7
TUNNEL
24072
240
S-24067
SEPTK
S-24065
24066
24068
4032.6
S-24073
SEPTK
4035.9
4042.9
24025
4041.3
242

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF 1

CALCULATED BY TR DATE 4/03/92

CHECKED BY ______ DATE ______

SCALE ______

LC 38 CONSOLIDATED CHILLER PLANT STUDY.

BASELINE DATA FOR

BLDGS P23638, P23640, P23642, P24072

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF 1

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY TF DATE 4/03/92

CHECKED BY DATE

SCALE

LC38 CHILLER PLANT

ENERGY & DEMAND SUMMARY

(TAKEN FROM TRACE 600 EQUIPMENT REPORTS)

BLDG.	KWH	Σ monthly KW*	KWH SAVINGS	KW SAVINGS
23638	963,730	680.8		
23640	689,253	323.1		
23642	341,507	386.3		
24072	438,375	111.9		
TOT. BASELINE	2,432,865	1502.1		
ALT #1A	1,113,018	1494.4	1,319,847	7.7
ALT #1B	1,058,413	934.9	1,374,452	567.2
** ALT #2A	1,268,502	1406.0	1,164,363	96.1
** ALT #2B	1,213,571	811.1	1,219,294	691.0

* CHILLED WATER EQUIPMENT ONLY WITH BLDG CHW PUMP EXCLUDED.

** ALT #2A & 2B INCLUDE THE PROPOSED PLANT PLUS DZ4072.

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLDG 23638 BASELINE

------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	54,631	105	4,953	0	11
Feb	49,354	105	3,859	0	10
March	52,451	105	673	0	5
April	51,481	143	0	2	0
May	104,657	212	0	69	0
June	123,490	221	0	114	0
July	131,167	225	0	133	0
Aug	129,758	221	0	122	0
Sept	105,979	211	0	67	0
Oct	55,419	158	0	3	0
Nov	51,033	105	1,218	0	6
Dec	54,312	105	3,742	0	9
Total	963,730	225	14,445	510	11

Building Energy Consumption = 124,258 (Btu/Sq Ft/Year) Floor Area = 38,096 (Sq Ft)
Source Energy Consumption = 125,430 (Btu/Sq Ft/Year)

Σ monthly kW FOR CHW EQUIPMENT = 680.8

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
0	LIGHTS														
	ELEC	7257	6564	7813	6933	7535	7490	6979	7813	6933	7535	6933	6979		86,766
	PK	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1		38.1
1	MISC LD														
	ELEC	850	769	931	809	890	890	809	931	809	890	809	809		10,196
	PK	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8		4.8
2	MISC LD														
	GAS	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ1001S		2-STG CTV <555 TONS												
	ELEC	0	0	0	656	21638	33016	38548	36183	21837	1059	0	0		152,936
	PK	0.0	0.0	0.0	47.4	58.1	66.0	68.4	65.3	55.8	45.4	0.0	0.0	406.4	68.4
1	EQ5100		COOLING TOWER												
	ELEC	0	0	0	0	8579	13428	13876	13876	11563	1138	0	0		62,459
	PK	0.0	0.0	0.0	0.0	18.6	18.6	18.6	18.6	18.6	18.6	0.0	0.0	111.6	18.6
1	EQ5100		COOLING TOWER												
	WATER	0	0	0	2	69	114	133	122	67	3	0	0		510
	PK	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.0	0.0		0.3
1	EQ5001		CHILLED WATER PUMP C.V.												
	ELEC	0	0	0	776	9176	10742	11100	11100	9250	910	0	0		53,055
	PK	0.0	0.0	0.0	14.9	14.9	14.9	14.9	14.9	14.9	14.9	0.0	0.0		14.9
1	EQ5010		CONDENSER WATER PUMP C.V.												
	ELEC	0	0	0	1164	13764	16114	16651	16651	13876	1365	0	0		79,583
	PK	0.0	0.0	0.0	22.4	22.4	22.4	22.4	22.4	22.4	22.4	0.0	0.0	156.8	22.4

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

	ELEC	0	0	0	52	615	720	744	744	620	61	0	0		3,556
	PK	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	6	1.0
1	EQ4001			AIRFOIL CENTRIF. FAN C.V.											
	ELEC	42460	38351	42460	41090	42460	41090	42460	42460	41090	42460	41090	42460		499,934
	PK	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1		57.1
1	EQ2001			GAS FIRE TUBE HOT WATER											
	GAS	4953	3859	673	0	0	0	0	0	0	0	1218	3742		14,445
	PK	10.7	10.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	8.6		10.7
1	EQ5020			HEAT WATER CIRC. PUMP C.V.											
	ELEC	2775	2507	847	0	0	0	0	0	0	0	1167	2775		10,071
	PK	3.7	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.7		3.7
1	EQ5240			BOILER FORCED DRAFT FAN											
	ELEC	917	828	285	0	0	0	0	0	0	0	734	917		3,680
	PK	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2		1.2
1	EQ5307			BOILER CONTROLS											
	ELEC	372	336	116	0	0	0	0	0	0	0	298	372		1,494
	PK	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5		0.5

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 225.3 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1001S	2-STG CTV <555 TONS	125.4	55.65
Sub Total			125.4	55.65
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	57.1	25.33
Sub Total			57.1	25.33
Sub Total			0.0	0.00
Miscellaneous				
Lights			38.1	16.91
Base Utilities			0.0	0.00
Misc Equipment			4.8	2.11
Sub Total			42.9	19.02
Grand Total			225.3	100.00

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLDG. 23640 BASELINE

------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	55,976	107	1,318	28	2
Feb	50,346	107	982	24	1
March	55,358	110	250	23	0
April	54,671	113	0	27	0
May	59,801	116	0	39	0
June	60,645	118	0	46	0
July	63,781	120	0	53	0
Aug	63,876	119	0	51	0
Sept	58,739	115	0	39	0
Oct	56,848	111	4	26	0
Nov	53,568	107	484	24	1
Dec	55,643	107	1,060	27	1
Total	689,253	120	4,098	407	2

Building Energy Consumption = 413,692 (Btu/Sq Ft/Year)   Floor Area = 6,677 (Sq Ft)
Source Energy Consumption = 415,590 (Btu/Sq Ft/Year)

Σ monthly chilled water equipment KW = 323.1

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N ----------------------------------

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
0	LIGHTS														
	ELEC	4573	4136	4924	4369	4749	4720	4398	4924	4369	4749	4369	4398		54,679
	PK	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0		24.0
1	MISC LD														
	ELEC	14485	13085	14592	14000	14538	14108	14431	14592	14000	14538	14000	14431		170,802
	PK	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3		24.3
2	MISC LD														
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060		4,098
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4		1.8
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ1070L	WTR-CLD RECIP >30 TONS													
	ELEC	6271	5435	5215	6201	8733	10592	12684	12093	9143	5988	5535	6169		94,057
	PK	17.2	17.6	19.4	21.1	24.2	26.7	28.4	27.1	23.1	19.2	17.2	17.2	25815	28.4
1	EQ5101	COOLING TOWER													
	ELEC	47	50	27	487	1180	1613	1667	1667	1613	972	49	44		9,415
	PK	0.6	0.8	0.8	2.2	2.2	2.2	2.2	2.2	2.2	2.2	0.6	0.8	19	2.2
1	EQ5101	COOLING TOWER													
	WATER	28	24	23	27	39	46	53	51	39	26	24	27		407
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1
1	EQ5001	CHILLED WATER PUMP C.V.													
	ELEC	5550	5013	5550	5371	5550	5371	5550	5550	5371	5550	5371	5550		65,350
	PK	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5		7.5
1	EQ5011	CONDENSER WATER PUMP C.V.													
	ELEC	2775	2507	2775	2686	2775	2686	2775	2775	2686	2775	2686	2775		32,675
	PK	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	44.4	3.7

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

	EQ5302	Controls													
	ELEC	74	67	74	72	74	72	74	74	72	74	72	74		876
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2	0.1
1	EQ4003	FC CENTRIF. FAN C.V.													
	ELEC	22201	20052	22201	21485	22201	21485	22201	22201	21485	22201	21485	22201		261,398
	PK	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8		29.8
1	EQ2002	GAS FIRE TUBE STEAM													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ5020	HEAT WATER CIRC. PUMP C.V.													
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ5061	CONDENSATE RETURN PUMP													
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ5240	BOILER FORCED DRAFT FAN													
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ5307	BOILER CONTROLS													
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S -------------------------------------

Utility ELECTRIC DEMAND

Peak Value 120.0 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	41.9	34.92
Sub Total			41.9	34.92
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	29.8	24.86
Sub Total			29.8	24.86
Sub Total			0.0	0.00
Miscellaneous				
Lights			24.0	20.00
Base Utilities			0.0	0.00
Misc Equipment			24.3	20.21
Sub Total			48.3	40.22
Grand Total			120.0	100.00

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLDG. 23642 BASELINE

------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	28,238	85	260	0	3
Feb	24,822	80	224	0	3
March	24,340	78	38	2	2
April	23,243	90	0	7	0
May	30,378	94	0	19	0
June	33,920	99	0	27	0
July	35,824	100	0	30	0
Aug	36,333	99	0	29	0
Sept	29,643	96	0	18	0
Oct	24,715	90	0	7	0
Nov	23,321	78	60	1	2
Dec	26,730	78	162	0	2
Total	341,507	100	744	139	3

Building Energy Consumption = 131,991 (Btu/Sq Ft/Year)   Floor Area = 9,394 (Sq Ft)
Source Energy Consumption = 132,236 (Btu/Sq Ft/Year)

Σ monthly kW for chilled water equipment = [illegible]

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
0	LIGHTS														
	ELEC	6202	5649	6756	6024	6479	6479	6024	6756	6024	6479	5828	6024		74,725
	PK	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6		24.6
1	MISC LD														
	ELEC	1185	1079	1291	1151	1238	1238	1151	1291	1151	1238	1113	1151		14,275
	PK	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7		4.7
2	MISC LD														
	GAS	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ1070L	WTR-CLD RECIP >30 TONS													
	ELEC	0	0	390	1576	4524	6400	7507	7296	4542	1691	246	0		34,171
	PK	18.1	18.1	18.1	18.1	18.1	22.7	23.7	23.2	20.4	18.1	18.1	18.1	314.1	23.7
1	EQ5101	COOLING TOWER													
	ELEC	0	0	0	634	1746	2320	2618	2544	1809	865	0	0		12,537
	PK	0.0	0.0	0.0	3.7	3.7	3.7	3.7	3.7	3.7	3.7	0.0	0.0	25.1	3.7
1	EQ5101	COOLING TOWER													
	WATER	0	0	2	7	19	27	30	29	18	7	1	0		139
	PK	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0		0.1
1	EQ5001	CHILLED WATER PUMP C.V.													
	ELEC	0	0	515	1322	2621	3483	3931	3819	2716	1394	336	0		20,138
	PK	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6		5.6
1	EQ5011	CONDENSER WATER PUMP C.V.													
	ELEC	0	0	343	880	1746	2320	2618	2544	1809	929	224	0		13,413
	PK	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	44.4	3.7

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

	ELEC	0	0	9	24	47	62	70	68	49	25	6	0		360
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2	0.1
1	EQ4003	FC CENTRIF. FAN C.V.													
	ELEC	5580	5040	5580	5400	5580	5400	5580	5580	5400	5580	5400	5580		65,700
	PK	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5		7.5
2	EQ4003	FC CENTRIF. FAN C.V.													
	ELEC	5580	5040	5580	5400	5580	5400	5580	5580	5400	5580	5400	5580		65,700
	PK	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5		7.5
3	EQ4003	FC CENTRIF. FAN C.V.													
	ELEC	781	707	856	744	818	818	744	856	744	818	744	744		9,374
	PK	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6		18.6
1	EQ2263	ELECTRIC RESISTANCE HEATING													
	ELEC	4247	3406	1539	0	0	0	0	0	0	5	2121	3740		15,058
	PK	6.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	6.0	6.0		6.0
2	EQ2263	ELECTRIC RESISTANCE HEATING													
	ELEC	3095	2497	952	0	0	0	0	0	0	0	1232	2490		10,266
	PK	6.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.0		6.0
3	EQ2001	GAS FIRE TUBE HOT WATER													
	GAS	260	224	38	0	0	0	0	0	0	0	60	162		744
	PK	2.6	2.5	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.3		2.6
3	EQ5020	HEAT WATER CIRC. PUMP C.V.													
	ELEC	542	475	105	0	0	0	0	0	0	0	142	394		1,659
	PK	1.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5		1.5
3	EQ5240	BOILER FORCED DRAFT FAN													
	ELEC	804	726	332	69	0	0	0	0	0	86	414	804		3,234
	PK	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1		1.1
3	EQ5307	BOILER CONTROLS													
	ELEC	223	202	92	19	0	0	0	0	0	24	115	223		898
	PK	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3		0.3

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

U T I L I T Y   P E A K   C H E C K S U M S

Utility ELECTRIC DEMAND

Peak Value 99.8 (kW)
Yearly Time of Peak 10 (hr) 7 (mo)

Hour 10 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	36.9	36.96
Sub Total			36.9	36.96
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	7.5	7.52
2		SUMMATION OF FAN ELECTRICAL DEMAND	7.5	7.52
3		SUMMATION OF FAN ELECTRICAL DEMAND	18.6	18.65
Sub Total			33.6	33.68
Sub Total			0.0	0.00
Miscellaneous				
Lights			24.6	24.65
Base Utilities			0.0	0.00
Misc Equipment			4.7	4.71
Sub Total			29.3	29.36
Grand Total			99.8	100.00

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLDG. 24072 BASELINE

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	35,029	53	2,656	6
Feb	31,816	53	1,873	6
March	35,953	53	265	3
April	29,005	46	0	0
May	37,614	67	0	0
June	42,261	77	0	0
July	46,636	80	0	0
Aug	43,333	76	0	0
Sept	35,897	67	0	0
Oct	30,035	46	0	0
Nov	34,984	53	335	3
Dec	35,812	53	1,627	4
Total	438,375	80	6,756	6

Building Energy Consumption = 61,598 (Btu/Sq Ft/Year)   Floor Area = 35,257 (Sq Ft)
Source Energy Consumption = 62,191 (Btu/Sq Ft/Year)

‡

Σ kW for all months = 111.9 (chilled water equipment)

24072

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N ------------------------------------

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
0	LIGHTS														
	ELEC	15892	14354	15892	15379	15892	15379	15892	15892	15379	15892	15379	15892		187,114
	PK	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4		21.4
1	MISC LD														
	ELEC	1223	1106	1339	1165	1281	1281	1165	1339	1165	1281	1165	1165		14,673
	PK	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9		6.9
2	MISC LD														
	GAS	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		[illegible]
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		[illegible]
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ1121L	AIR-CLD RECIP 35-60 TONS													
	ELEC	0	0	0	0	3866	8166	11022	8246	3293	0	0	0		34,593
	PK	0.0	0.0	0.0	0.0	14.0	17.5	20.3	17.0	13.6	0.0	0.0	0.0	Σ 82.4	20.3
1	EQ5200	CONDENSER FANS													
	ELEC	0	0	0	0	635	1515	1983	1387	549	0	0	0		6,069
	PK	0.0	0.0	0.0	0.0	2.2	7.9	7.9	7.9	2.1	0.0	0.0	0.0	28.0	7.9
1	EQ5001	CHILLED WATER PUMP C.V.													
	ELEC	0	0	0	0	2544	2686	2775	2775	2574	0	0	0		13,353
	PK	0.0	0.0	0.0	0.0	3.7	3.7	3.7	3.7	3.7	0.0	0.0	0.0		3.7
1	EQ5313	CONTROLS													
	ELEC	0	0	0	0	205	216	223	223	207	0	0	0		1,074
	PK	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	1.5	0.3
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS													
	ELEC	3219	3077	3997	1523	1860	2033	2213	2116	1767	1561	4196	4050		31,612
	PK	4.7	4.7	4.7	4.7	3.5	3.9	4.0	3.9	3.3	2.7	4.7	4.7		4.7

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

24072

	Condenser Fans													
	ELEC	115	109	144	160	194	208	225	216	186	163	134	125	1,979
	PK	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.4
2	EQ5306	CONTROLS												
	ELEC	37	34	37	36	37	36	37	37	36	37	36	37	438
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1	EQ4003	FC CENTRIF. FAN C.V.												
	ELEC	11100	10026	11100	10742	11100	10742	11100	11100	10742	11100	10742	11100	130,699
	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
1	EQ2002	GAS FIRE TUBE STEAM												
	GAS	2656	1873	265	0	0	0	0	0	0	0	335	1627	6,756
	PK	6.4	5.7	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	4.1	6.4
1	EQ5020	HEAT WATER CIRC. PUMP C.V.												
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ5240	BOILER FORCED DRAFT FAN												
	ELEC	1406	1270	1406	0	0	0	0	0	0	0	1361	1406	6,849
	PK	1.9	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	1.9
1	EQ5061	CONDENSATE RETURN PUMP												
	ELEC	1665	1504	1665	0	0	0	0	0	0	0	1611	1665	8,111
	PK	2.2	2.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2	2.2
1	EQ5307	BOILER CONTROLS												
	ELEC	372	336	372	0	0	0	0	0	0	0	360	372	1,812
	PK	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

24072

UTILITY PEAK CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 79.8 (kW)
Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	32.2	40.37
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	4.5	5.60
Sub Total			36.7	45.97
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.69
Sub Total			14.9	18.69
Sub Total			0.0	0.00
Miscellaneous				
Lights			21.4	26.76
Base Utilities			0.0	0.00
Misc Equipment			6.9	8.58
Sub Total			28.2	35.34
Grand Total			79.8	100.00

JOB WSMR ESOI STUDY #1110-000

SHEET NO. 2 OF 2

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY A NIEMEYER DATE 4/01/92

CHECKED BY T F DATE 4/01/92

SCALE

LC 38 EQUIPMENT COST SUMMARY

	RECURRING MAINT. COST ($/YR)	NON RECURRING COSTS		
		YEAR OF REPLACEMENT	REPLACEMENT COST ($)	MAINT. COST $
BASELINE	9,709	1	283,750	8,512
		5	39,900	1,197
ALT #1A		1	533,942	16,018
ALT #1B		1	559,565	16,787
ALT #2A		1	261,796	7,854
ALT #2B		1	297,706	8,931

DIFFERENTIAL COSTS

	RECURRING COSTS ($)	NON RECURRING COSTS	
		Year	$
ALT# 1A	−6,309	1	+283,750
		5	39,900
ALT #1B	−7,078	1	+283,750
		5	39,900
ALT #2A	648	1	+283,750
		5	0
ALT #2B	−419	1	+283,750
		5	0

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

JOB WSMR ESOS STUDY #1110.000

SHEET NO. 1 OF 1

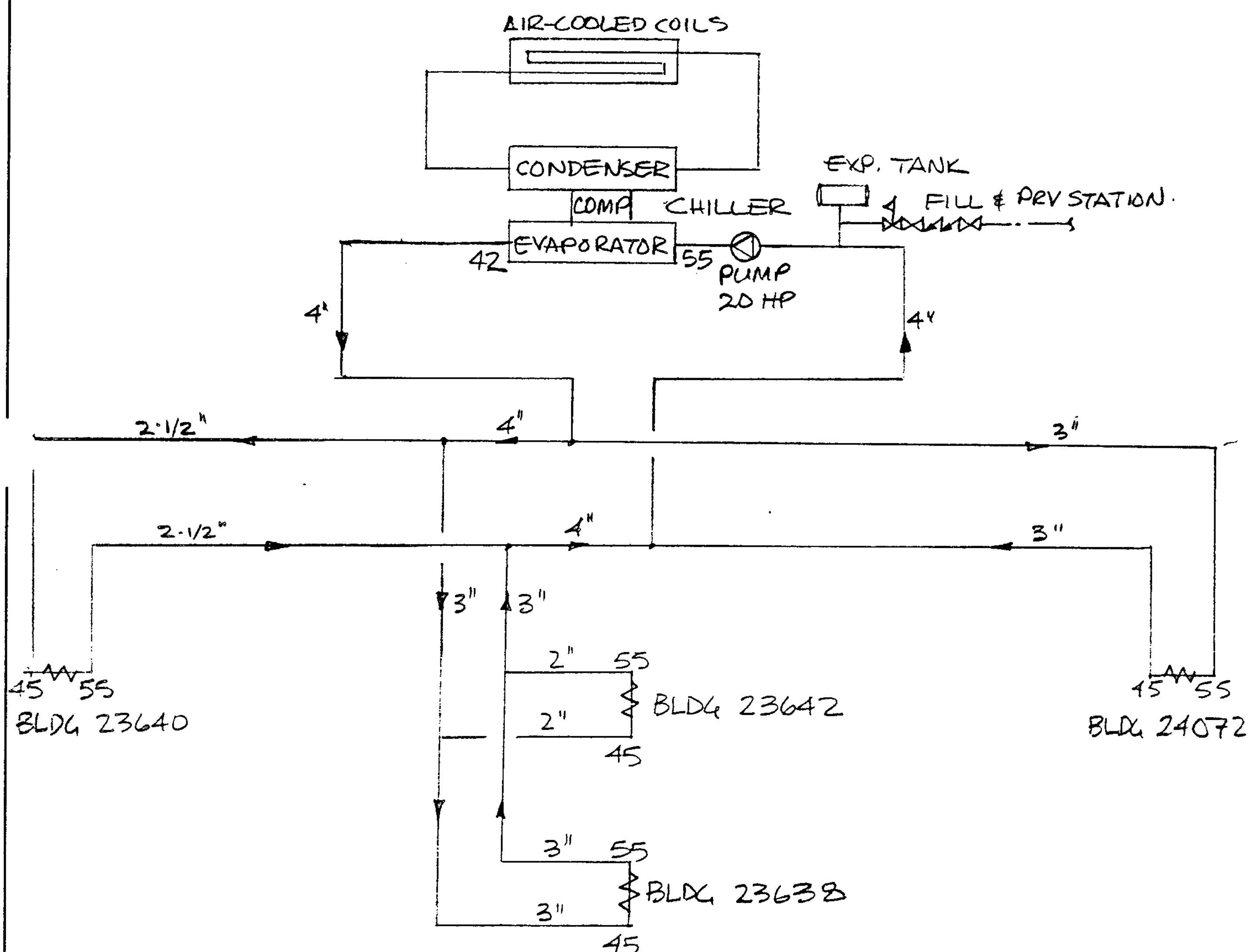
CALCULATED BY C. Butler DATE 3.11.92

CHECKED BY DATE

SCALE

LAUNCH COMPLEX #38
ALT. #1A

SCHEMATIC



LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: LAUNCH COMPLEX 38 – CHILLER PLANT STUDY – ALT. 1A FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/05/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$533,942	
B. SIOH COST	(5.5% of 1A) =		$29,367	
C. DESIGN COST	(6.0% of 1A) =		$32,037	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$595,345	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =		———————>	$595,345

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	4,505	$29,190	15.23	$444,565	
B. DIST		0	$0	17.28	$0	
C. PROPANE	$6.71	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		4,505	29,190.1		———————>	$444,565

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) + (ANNUAL RECURRING MAINTENANCE COST) = ($6,159)

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = ($90,412)

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$283,750	1	0.96	$272,400
b. EQUIP REPLACEMENT COST	$39,900	5	0.80	$31,920
c.	$0		0.00	$0
d TOTAL	$323,650			$304,320

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $213,908

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $146,706

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.99

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$35,977
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$658,473
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.11
7 SIMPLE PAYBACK (SPB)	(1F/4) =	16.55

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): LAUNCH COMPLEX 38 (ALT 1A)

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	CHILLED WTR GEN, AIR-COOLED 200T (NOM), W/CONTROLS	EA	1	79500.00	79500	64	35.81	2291.84		$81,791.84
	PUMP, CENTRIF, 342 GPM, 20 HP	EA	2	3125.00	6250	32	35.81	2292		$8,541.84
	PIPE, INSULATED CONDUIT, 4"	LF	60	23.50	1410	0.72	35.81	1547		$2,956.99
	PIPE, INSULATED CONDUIT, 3"	LF	6820	18.90	128898	0.57	35.81	139208		$268,105.79
	PIPE, INSULATED CONDUIT, 2-1/2"	LF	960	16.30	15648	0.47	35.81	16157		$31,805.47
	PIPE, INSULATED CONDUIT, 2"	LF	100	16.10	1610	0.38	35.81	1361		$2,970.78
	TRENCH & BACKFILL, 24"x36"	LUMP SUM	3970 LF	2.81	11155.7					$11,155.70
	PAVEMENT, REMOVE & REPLACE	LUMP SUM	400 SF	5.93	2372					$2,372.00
	EXPANSION TANK & FILL STA.	LS	1	525.00	525	5.00	35.81	179		$704.05
	CONCRETE PAD FOR CHILLER	LUMP SUM	7.5 CY	100.00	750					$750.00
	PUMP HOUSING, PREFAB METAL	LUMP SUM	100 SF	30.00	3000					$3,000.00
	VALVE, BFLY, CL 150, 4"	EA	4	90.00	360	3.20	35.81	458		$818.37
	INTERCONNECT @ EA BLDG.	EA	4	7000	28000	280.00	35.81	40107		$68,107.20
	ETHYLENE GLYCOL	GAL	900	5.9	5310	0.01	35.81	322		$5,632.29
	SUBTOTAL									$488,712.33
	OVERHEAD & PROFIT (25%)									$122,178.08
	CONTINGENCY (10%)									$61,089.04
	TOTAL THIS SHEET									$671,979.45

ESTIMATE SUMMARY

PROJECT: WSMR ESOS STUDY #1110-000

LAUNCH COMPLEX #38

ESTIMATE NO. ALT. # 1A
SHEET NO. 1
PREPARED BY: C. Butler DATE: 3.16.92
CHECKED BY: DATE:

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M.H.	TOTAL M.H.	RATE	AMOUNT	UNIT PRICE	AMOUNT	
R. 15-1	CHILLED WTR GEN. AIR-COOL'D										
	200 T (NOM) W/CONTROLS.	1 EA.	79,500	79500	64	64	25	1600			81100
R-15-3	PUMP, CENTRIF 342GPM, 20HP	2 EA	3125	6250	32	64	25	1600			7850
M.151.851.0730	PIPE, INSULATED CONDUIT, 4"	60 LF	23.50	1410	.72	43	25	1080			2490
.0720	" " " , 3"	6820 LF	18.90	128900	.57	3887	25	97180			226080
.0710	" " " , 2-1/2"	960 LF	16.30	15650	.47	451	25	11280			26930
.0700	" " " , 2"	100 LF	16.10	1610	.38	38	25	950			2560
R.2-14, 2-17, 2-21	TRENCH & BACKFILL, 24"x36"	3970 LF							2.81	11160	11160
M.020, 025	PAVEMENT REMOVE & REPLACE	400 SF							5.93	2370	2370
—	EXPANSION TANK & FILL STA.	1 LS	525	525	5.0	5.0	25	125			650
M.033.130.4701	CONCRETE PAD FOR CHILLER	7.5 CY							100	750	750
M.970.0010	PUMP HOUSING, PREFAB METAL	100 SF							30	3000	3000
M.151.960.1060	VALVE, BFLY, CL 150, 4"	4 EA	90	360	3.2	12.8	25	320			680
—	INTERCONNECT @ EA BLDG.	4 EA	7000	28000	280	1120	25	28000			56000
M.157.401.1200	ETHYLENE GLYCOL	900 GAL	5.90	5310	0.01	9	25	230			5540
											427,160

JOB WSMR ESOS STUDY #1110.000
SHEET NO. 1 OF
CALCULATED BY C. Butler DATE 3.10.92
CHECKED BY DATE
SCALE

E M C ENGINEERS, INC.
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LAUNCH COMPLEX #38
ALT. 1A.

A. FLOW RATES:

BLDG #	DESIGN PK LOAD	× GPM/TON R.	= GPM.	
23640	36.2 TON R.	2.4	86.9	87
23642	32.3 " "	↓	77.5	78
23638	45.0 " "		108.0	108
24072	28.8 " "		69.1	69

B. PIPE SIZING:

GPM	PIPE SIZE	VEL, FPS	P.D. 1/100LF	LENGTH*	P.D.	CUM TOT P.D.
87	2-1/2"	5.8	5.44	960	52.22	54.68
78	2"	7.5	10.88	100	10.88	10.88
108	3"	4.7	2.75	1220	33.55	33.55
186	3"	8.1	7.76	180	13.97	47.52
273	4"	6.9	4.10	60	2.46	49.98
69	3"	3.0	1.19	5420	64.50	64.50

* LENGTH INCLUDES SUPPLY & RETURN PIPING (TRENCH LENGTH = 1/2 L.)

C. ESTIMATED PUMP BHP:

$$BHP = \frac{GPM \times HD' \times SP.GR.}{3960 \times efficiency} = \frac{342 \times (65+15+50)^{\dagger} \times 1.04}{3960 \times 0.70} = \underline{16.7}$$

† 15' = CHILLER P.D.
50' = BLDG SYSTEM P.D.

D. PUMP MOTOR HP:

$$MHP = 1.2^{\dagger\dagger} \times BHP = 1.2(16.7) = \underline{\underline{20.0\ HP.}}$$

†† 1.2 ALLOWS FOR BELT DRIVE FRICTION LOSSES.

JOB WSMR FSOS STUDY # 1110.000

SHEET NO. 2 OF

E M C ENGINEERS, INC.

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CALCULATED BY C. Butler DATE 3.11.92

CHECKED BY DATE

SCALE

LAUNCH COMPLEX #38
ALT. # 1A

E. CHILLER SELECTION:

CAPY REQD = 142.3 TONS. R. (FROM. A.-FLOW RATES.); GPM = 342

AMBIENT TEMP = 115°F

ELEVATION = ~4000' MSL.

BRINE SOLN = 30% ETHYLENE GLYCOL (BY WEIGHT.); SP. GR. ≃ 1.04

ADJUSTMENT FACTORS:

FOULING FACTOR = 0.00025, ALT. ~4000': CAPY × 0.960; GPM × 0.970; KW × 1.030

30% ETHYLENE GLYCOL: CAPY × 0.975; GPM × 1.064; KW × 0.99

$$\therefore \text{CAPY} = \frac{142.3}{0.960 \times 0.975} = 152.0 \text{ TONS R.}$$

$$\text{GPM} = \frac{342}{0.970 \times 1.064} = 331.4$$

USE A TRANE "RTAA 200" ROTARY COMPRESSOR, AIR-COOLED COLD GEN.

CAPY @ 115°COND TEMP & 42°LWT. = 151.6 TONS R.

KW = 229.4 × 1.030 × 0.99 = 222.1

KW/TON = 222.1 / 151.6 = 1.465.

E M C ENGINEERS, INC.	JOB WSMR - ESOS STUDY # 1110.000
Denver • Colorado Springs • Atlanta • Germany	SHEET NO. 1 OF 1
	CALCULATED BY C. Butler DATE 3.11.92
PRICES FOR ESTIMATING.	CHECKED BY ____ DATE ____
ROGER HUBERT 779-0787	SCALE ____

FROM TRANE: @ 115°F AMB TEMP., 42° LWT

ALT. 1A. - RTAA 200 142.3T.
(30% GLYCOL SOLN)

ALT. 1B - RTHA 150? 142.3T
(80°-95° COND Δt, 55°-42° EVAP ΔT)
(30% GLYCOL SOLN)

ALT. 2A - RTAA 140 113.5T.
(30% GLYCOL SOLN)

ALT. 2B - RTHA 130 113.5T
(80°-95° COND Δt, 55°-42° EVAP ΔT)

Y-Δ Starters.

COOLING TOWERS FROM BAC, BOB LINDE

ALT. 1B 3165	JE 165	$13,730 + 400.00 (HTR)	3 HP & 10 HP (ENERGY MISER)
ALT. 2B 3130	JE 130	$12000 INCL. 400.00	2 HP & 5 HP (" ")

USE 2 WINDING STARTER.

USE 1200— FOR INSTALLATION (48 MH @ $25.00/MH)

JOB WSMR ESOS STUDY # 1110.000

E M C ENGINEERS, INC.
Denver • Colorado Springs • Atlanta • Germany

SHEET NO. 1 OF

CALCULATED BY C. Butler DATE 3.12.92

CHECKED BY DATE

SCALE

LAUNCH COMPLEX # 38
ALT'S 1A, 1B, 2A, 2B

COST ESTIMATING: REF: RICHARDSON "PLANT CONSTRUCTION EST'G STDS"

1. SECTION 2-17 · STRUCTURAL EXCAVATION W/ CLEVELAND JS-36 TRENCHER
   P. 3 TRENCH 24" WIDE × 3'-0" DEEP IN CLASS A OR B MATL:
   OUTPUT: 131.8 CY/HR (BANK MEASURE)

COSTS: EQUIP.

TRENCHER @ 68.50/HR
PICKUP TRUCK @ 9.50/HR
78.00/HR.

CREW:

FOREMAN @ $24.15/HR.
OPERATOR @ 23.65/HR
LABORER @ 18.00/HR
$65.80/HR

LABOR & EQUIP. TOTAL $143.80/HR

2. SECTION 2.12, P.1 VOLUME OF EXCAVATION + FALL-IN FACTOR:

3'-0" DEPTH = .1112 CY/FT WIDTH × FT LENGTH + .0556 CY/FT·FT LOOSE MATL

FOR 24" WIDTH = (2 × .1112) + .0556 = 0.278 CY/LF.

$$\text{TIME REQD} = \frac{131.8 \text{ CY/HR}}{0.278 \text{ CY/LF}} = 474.1 \text{ LF/HR}.$$

ALT 1A: 6012 / 474.1 = 12.7 SAY 16 HR × 144 $/HR + $240 ≅ $2550
ALT 1B: SAME 12.7 " " ≅ $2550
ALT. 2A: 1000/474.1 = 2.11 " 4 HR ≅ $820
ALT. 2B: SAME ≅ $820

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LAUNCH COMPLEX #38
ALTS 1A, 1B, 2A, 2B.

JOB WSMR ESOS STUDY # 1110.000
SHEET NO. 2 OF
CALCULATED BY C. Butler DATE 3-12-92
CHECKED BY DATE
SCALE

3. SECTION 2-21, P.2: STRUCTURAL BACKFILL & COMPACTION

FOR 6" LIFTS: CLASS "A" MATERIAL
OUTPUT = 25 CY/HR (BANK MEASURE)

COSTS:

EQUIP.	1-CAT 930 LOADER	$44.00/HR
	2-21"x24" PAN TYPE COMPACTOR	$6.00/HR
	1-PICKUP TRUCK	$9.50/HR
		$59.50/HR
CREW	FOREMAN	24.15/HR
	OPERATOR	23.65/HR
	4-LABORERS.	72.00/HR
		$119.80/HR

EQUIP & LABOR TOTAL $179.30/HR

TIME REQD.:
@ 0.278 CY/LF ÷ 25 CY/HR = 0.01112 HR/LF

ALT 1A	6012 LF x 0.01112 HR/LF	≅ 66.9 SAY	68 HRS.
1B	SAME	≅	68 HRS.
2A	1000 LF x 0.01112 HR/LF	≅ 11.12 SAY	12 HRS
2B	SAME	≅	12 HRS.

ALT. 1A 68 HRS x $179.30/HR + $125 MOVE-ON COSTS = $12,320.
1B
2A 12 HRS x $179.30/HR + $125 MOVE-ON COSTS = $2,280.
2B

JOB WSMR ESOS STUDY # 1110.000

SHEET NO. 3 OF

CALCULATED BY C. Butler DATE 3.12.92

CHECKED BY DATE

SCALE

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LAUNCH COMPLEX #38

ALT'S 1A, 1B, 2A, 2B

4. SECTION 2-14, p.2, STRUCTURAL EXCAVATION WITH A CASE 580 LOADER-BACKHOE
   TRENCH 24" WIDE × 3'-0" DEEP IN CLASS A MATL.
   OUTPUT: 30.7 CY/HR. (BANK MEASURE)

COSTS:

EQUIP.	CASE 580 BACKHOE	$35.00/HR.
	PICKUP TRUCK	$ 9.50/HR
		$ 44.50/HR.
CREW:	FOREMAN	$ 24.15/HR
	OPERATOR	$ 23.65/HR
	LABORER	$ 18.00/HR
		$ 65.80/HR
	EQUIP & CREW TOTAL	$110.30/HR.

5. FROM PARA. 2; p. 1

$$\text{TIME REQD.} = \frac{30.7\ \text{CY/HR}}{0.278\ \text{CY/LF}} = 110.4\ \text{LF/HR}$$

ALT. 1A & 1B : 720 LF / 110.4 LF/HR = 6.5 SAY 12 HRS
ALT. 2A & 2B : 280 LF / 110.4 LF/HR = 2.5 SAY 5 HRS

ALT. 1A & 1B; 12 HRS × $110.30/HR ≅ $1325
ALT. 2A & 2B: 5 HRS × $110.30/HR ≅ $ 550

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LAUNCH COMPLEX #38

ALT'S 1A, 1B, 2A, 2B

JOB WSMR ESDS STUDY #1110.000

SHEET NO. 4 OF

CALCULATED BY C. Butler DATE 3.12.92

CHECKED BY DATE

SCALE

6. PAVEMENT:

A. PAVEMENT REMOVAL:

ALT. 1A & 1B. APPROX 400 SQ FT × 4" THK = 4.9 CY (≃ 400 LF CUT)

ALT. 2A & 2B: APPROX 260 SQ FT × 4" THK = 3.2 CY (≃ 260 LF CUT)

1. REF: MEANS 020 728 0010, 0020: SAW CUTTING TO 4" DEPTH.

MATL .22 + .05 = $.27/LF

LABOR .42 + .26 = $.68/LF

EQUIP. .33 + .21 = $.54/LF

$1.49/LF

ALT 1A & 1B, 400 × 1.49 ≅ 600

ALT 2A & 2B, 260 × 1.49 ≅ 400

ALT. 1A & 1B: 400 LF × $1.49/LF ≅ $600 × 1.5 = $900 –

ALT. 2A & 2B: 260 LF × $1.49/LF ≅ $400 × 1.5 = $600 –

ESCALATED FOR SMALLER SIZE JOB.

2. REF: MEANS 020 554 1750, 5550: PAVEMENT REMOVAL & ON-SITE DISPOSAL.

MATL:	NONE		
LABOR:	1.93		1.42
EQUIP:	2.78		3.57
	$4.71/SY	+	$4.99/CY

ALT. 1A & 1B: 4.71 (400/9) + 4.99 (4.9) ≅ $240

ALT 2A & 2B: 4.71 (260/9) + 4.99 (3.2) = $160

B. REF: MEANS 025 120 0020, 0510: CONCRETE PAVING (SMALL IRREG. AREAS).

MATL: 12.57

LABOR: .59

EQUIP: .59

13.75 + 100% = $27.50/SY.

ALT. 1A & 1B: 400/9 S.Y. × $27.50/SY ≅ $1230

ALT 2A & 2B: 260/9 S.Y. × $27.50/SY = $800

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LAUNCH COMPLEX # 38
ALTS 1A, 1B, 2A, 2B.

JOB WSMR ESOE STUDY # 1110,000

SHEET NO. 5 OF

CALCULATED BY C. Butler DATE 3.12.92

CHECKED BY DATE

SCALE

7. CIRCULATING PUMPS:

ALT. 1A - CHILLED BRINE PUMP:

2 - 273 GPM @ 130' HD WITH 20 HP MOTOR (460/3/60).
REF: RICHARDSON, SECTION 15-3, p. 1.
PUMP W/MOTOR & BASE: (USE 500GPM @ 100' HD, 20 HP MOTOR)
MATL: \$3125 -
LABOR: \$ 800 - (32 MH @ \$25.00/MH).
\$3925 - SAY \$4000 EA

ALT. 1B - CHILLED BRINE PUMP:

SAME AS ALT. 1A

ALT. 1B - CONDENSER WATER PUMP:

2 - 456 GPM @ 30' HD WITH 7.5 HP MOTOR (460/3/60)
REF: RICHARDSON, SECTION 15-3, P. 1
PUMP W/MOTOR & BASE: (USE 400 GPM @ 100' HD, 15 HP MOTOR)
MATL: \$ 2920 -
LABOR \$ 800 - (32 MH @ \$25.00/MH)
\$ 3720 - SAY \$3800 EA

ALT. 2A - CHILLED BRINE PUMP:

2 - 273 GPM @ 106' HD WITH 15 HP MOTOR (460/3/60)
REF: RICHARDSON, SECTION 15-3, P. 1
PUMP W/MOTOR & BASE: (USE 300 GPM @ 100' HD, 15 HP MOTOR)
MATL: \$2770 -
LABOR: \$ 800 -
\$3570 - SAY \$3600 EA

ALT. 2B - CHILLED BRINE PUMP: (SAME AS ALT. 2A)

ALT - 2B - CONDENSER WATER PUMP:

2 - 364 GPM @ 30' HD WITH 5 HP MOTOR (460/3/60)
PUMP W/ MOTOR & BASE: (USE 200 GPM @ 100' HD, 10 HP MOTOR)
MATL: \$2150 -
LABOR: \$ 600 - (24 MH @ \$25.00/MH)
\$2750 - SAY \$2800 EA

TRANE™

PROPOSAL

The Trane Company
A Division of
American Standard Inc.

TRANE COMPANY
5654 GREENWOOD PLAZA BLVD.
ENGLEWOOD, COLORADO 80111-23

Customer
MR. CHET BUTLER
EMC ENGINEERS
FAX NO:

Number WHITE
Date 3/12/92

Job Name WHITE SANDS, NM

Delivery Terms
FOB: FACTORY FREIGHT ALLOWED

Engineer
EMC ENGINEERS
DENVER, CO

Terms of Payment
NET: 30 DAYS

BUDGET PRICING

ITEM: A QTY: 1 DESCRIPTION: TRANE ROTARY AIR COOLED CHILLER
TAG (S):
1-A

> Air Cooled Series R Chiller
> 200 Tons NOMINAL
> 460V/60/3
> Y Delta Closed Transition Starter w/ Disconnect Switch
> U.L. Listing
> Deluxe Controller
> Architectural Louvered Panels
> Control Power Transformer
> 150 PSI Flow Switch
> FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS A TO A .... $ 79,500

ITEM: B QTY: 1 DESCRIPTION: TRANE ROTARY CHILLER
TAG (S):
1-B

Effective March, 1987, price increase terms will be administered as follows:
Prices stated in this proposal are firm provided that notification of release for immediate production and shipment is received at the factory not later than five months from order receipt. If such release is received later than five months from order receipt date but within eight months of order receipt date, prices will be increased a straight 1.0 percent (not compounded) for each one-month period (or part thereof) beyond the five-month firm price period up to the date of receipt of such release. If such release is not received within eight months after date of order receipt, the prices are subject to renegotiation or at the Company's option, the order will be cancelled. If for any reason Buyer delays shipment after release, prices are subject to increase as stated on the reverse side hereof.

Prices do not include taxes. See reverse side for terms and conditions of sale upon which this proposal is based.

1-26.130-4—(488)
Supersedes 1-26.130-4—(187)

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 LC-3B ALT 1A

------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	66,840	178	1,318	2
Feb	60,345	181	982	1
March	68,703	206	250	0
April	69,087	217	0	0
May	109,405	320	0	0
June	137,885	375	0	0
July	150,515	386	0	0
Aug	143,696	370	0	0
Sept	103,374	315	0	0
Oct	72,431	214	4	0
Nov	64,659	193	484	1
Dec	66,077	183	1,060	1
Total	1,113,018	386	4,098	2

Building Energy Consumption = 47,062 (Btu/Sq Ft/Year)
Source Energy Consumption = 132,276 (Btu/Sq Ft/Year)

Floor Area = 89,425 (Sq Ft)

Σ monthly kW FOR CHILLER PLANT = 1494.4

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 A

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
		Monthly Consumption													
0	LIGHTS														
	ELEC	33925	30704	35385	32706	34655	34068	33293	35385	32706	34655	32509	33293		403,284
	PK	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1		108.1
1	MISC LD														
	ELEC	17742	16039	18152	17125	17947	17516	17556	18152	17125	17947	17087	17556		209,946
	PK	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6		40.6
2	MISC LD														
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060		4,098
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4		1.8
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ1510.C	RTAA Air Cooled Series R chiller													
	ELEC	3793	3318	3715	7975	43759	72494	85019	75891	40946	8184	3974	3831		352,900
	PK	14.2	21.2	40.8	65.8	154.0	203.6	214.9	198.6	145.3	63.2	28.1	18.2	1267.9	214.9
1	EQ5200	CONDENSER FANS													
	ELEC	206	191	275	466	1869	2993	3472	3093	1782	470	274	222		15,312
	PK	0.7	0.9	1.7	2.9	6.1	7.8	7.8	7.8	5.8	2.8	1.3	0.8	46.5	7.8
1	EQ5001	CHILLED WATER PUMP C.V.													
	ELEC	11100	10026	11100	10742	11100	10742	11100	11100	10742	11100	10742	11100		130,699
	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	178.8	14.9
1	EQ5302	CONTROLS													
	ELEC	74	67	74	72	74	72	74	74	72	74	72	74		876
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2	0.1

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1 A

------------------------------------- U T I L I T Y   P E A K   C H E C K S U M S -------------------------------------

Utility ELECTRIC DEMAND

Peak Value 386.4 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1510.C	RTAA Air Cooled Series R chiller	237.8	61.54
Sub Total			237.8	61.54
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			108.1	27.97
Base Utilities			0.0	0.00
Misc Equipment			40.6	10.50
Sub Total			148.6	38.46
Grand Total			386.4	100.00

JOB WSMR ESOS STUDY #1110.000

SHEET NO. 1 OF 1

CALCULATED BY C. Butler DATE 3.16.92

CHECKED BY ______ DATE ______

SCALE ______

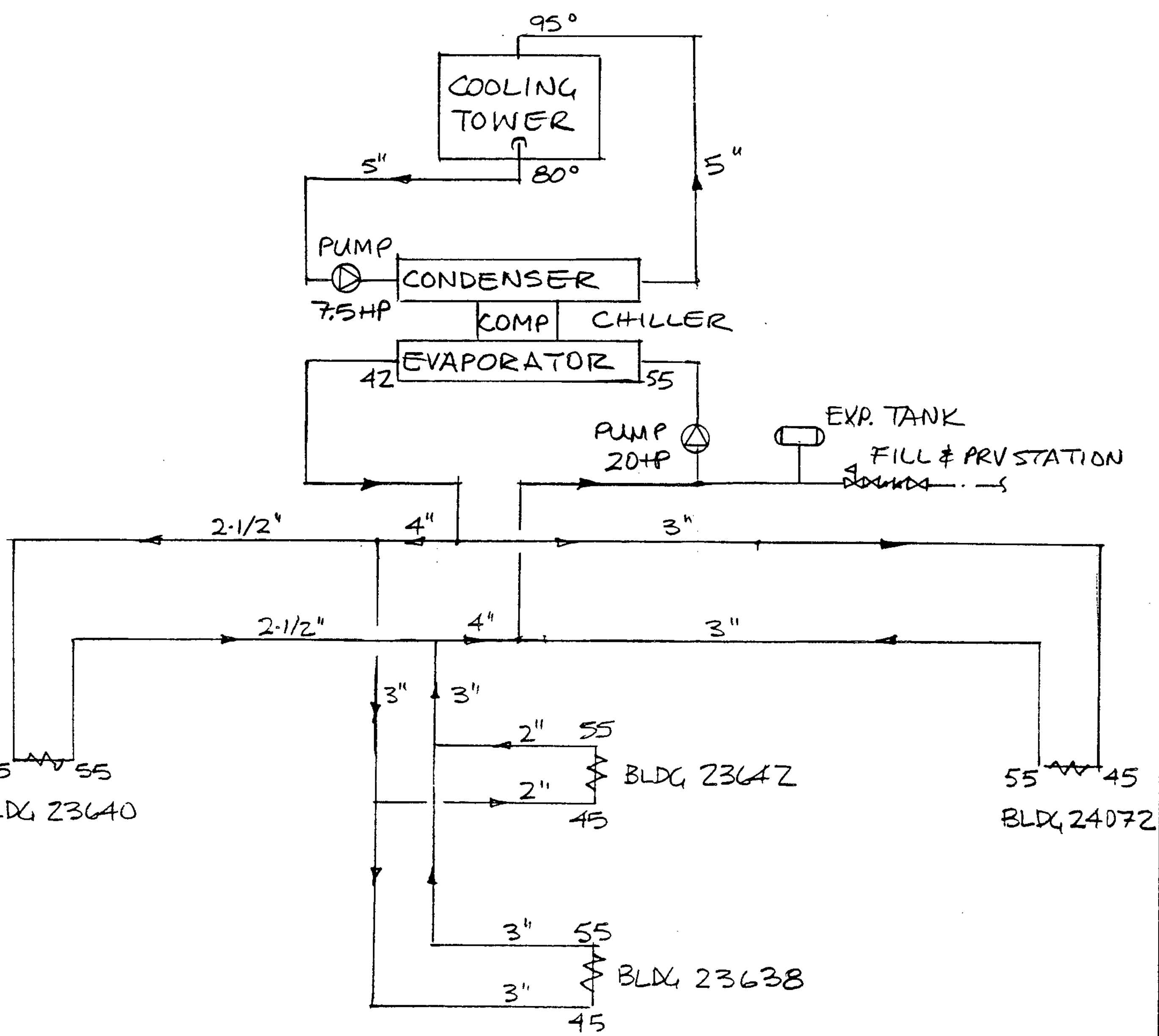
E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX #38

ALT. #1B.

SCHEMATIC



LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	LAUNCH COMPLEX 38 – CHILLER PLANT STUDY – ALT. 1B			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/15/92	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$703,072		
B. SIOH COST	(5.5% of 1A) =	$38,669		
C. DESIGN COST	(6.0% of 1A) =	$42,184		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$783,925		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D – 1E) =	————>		$783,925

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	4,691	$30,398	15.23	$462,957	
B. DIST		0	$0	17.28	$0	
C. PROPANE	$6.71	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		4,691	30,397.7		————>	$462,957

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) + (ANNUAL RECURRING MAINTENANCE COST)	=		$6,164	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$90,494	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$283,750	1	0.96	$272,400
b. EQUIP REPLACEMENT COST	$39,900	5	0.80	$31,920
c.	$0		0.00	$0
d TOTAL	$323,650			$304,320

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$394,814
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$152,776	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.79	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$49,508
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$857,771
6 DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.09
7 SIMPLE PAYBACK (SPB)	(1F/4) =	15.83

CONSTRUCTION COST ESTIMATE BREAKDOWN		*Form Approved* *Budget Bureau No. 22-R-100*
CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	
CONTRACT FOR (Work to be performed) LAUNCH COMPLEX 38 (ALT 1B)		PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	CHILLED WTR GEN, WTR-COOLED 150T (NOM)	EA	1	55800.00	55800	60	35.81	2148.6		$57,948.60
	COOLING TOWER, 285T	EA	1	14130.00	14130	48	35.81	1719		$15,848.88
	PUMP, CENTRIF. 342 GPM, 20 HP	EA	2	3125.00	6250	32	35.81	2292		$8,541.84
	PUMP, CENTRIF. 456 GPM, 7.5 HP	EA	2	2920.00	5840	32	35.81	2292		$8,131.84
	PIPE, INSULATED CONDUIT, 4"	LF	60	23.50	1410	0.72	35.81	1547		$2,956.99
	PIPE, INSULATED CONDUIT, 3"	LF	6820	18.90	128898	0.57	35.81	139208		$268,105.79
	PIPE, INSULATED CONDUIT, 2-1/2"	LF	960	16.30	15648	0.47	35.81	16157		$31,805.47
	PIPE, INSULATED CONDUIT, 2"	LF	100	16.10	1610	0.38	35.81	1361		$2,970.78
	TRENCH & BACKFILL, 24"x36"	LUMP SUM	3970 LF	2.81	11155.7					$11,155.70
	PAVEMENT, REMOVE & REPLACE	LUMP SUM	400 SF	5.93	2372					$2,372.00
	PIPE, BLK STEEL & FTTGS. 5"	LF	100	12.58	1258	0.50	35.81	1791		$3,048.50
	EXPANSION TANK & FILL STA.	LS	1	525.00	525	5.00	35.81	179		$704.05
	CONCRETE PAD FOR TOWER	LUMP SUM	6 CY	100.00	600					$600.00
	MISC. STEEL FOR TOWER	LBS	4000	0.75	3000	0.007	35.81	1003		$4,002.68
	STEEL BUILDING 20'x30'x12'	LUMP SUM	600 SF	30.00	18000					$18,000.00

-CONTINUED ON NEXT PAGE-

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR EMC ENGINEERS INC.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed) LAUNCH COMPLEX 38 (ALT 1B)	PROPOSED TOTAL CONTRACT PRICE
PURCHASE REQUEST NUMBER	PROJECT NUMBER
WORK LOCATION	WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	VALVE, BFLY, CL. 150, 5"	EA	2	115.00	230	4.8	35.81	344		$573.78
	VALVE, BFLY, CL. 150, 4"	EA	4	90.00	360	3.2	35.81	458		$818.37
	INTERCONNECT @ EA BLDG.	EA	4	7000.00	28000	280	35.81	40107		$68,107.20
	ETHYLENE GLYCOL	GAL	900	5.90	5310	0.01	35.81	322		$5,632.29
	SUBTOTAL									$511,324.76
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									$127,831.19 $63,915.60
	TOTAL THIS SHEET									$703,071.55

ESTIMATE SUMMARY

PROJECT: WSMR ESOS STUDY #1110.000
LAUNCH COMPLEX #38

ESTIMATE NO. ALT. #1B
SHEET NO.
PREPARED BY: C. Butler DATE: 3.16.92
CHECKED BY: DATE:

MAIN ACCOUNT *	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M.H.	TOTAL M.H.	RATE	AMOUNT	UNIT PRICE	AMOUNT	
R. 15-1	CHILLED WTR GEN, WTR-COOL'D										
	150 TON (NOM)	1 EA.	55800	55800	60	60	25-	1500			57300
R-15-2	COOLING TOWER, 285T	1 EA	14,130	14130	48	48	25-	1200			15330
R-15-3	PUMP, CENTRIF. 342GPM, 20HP	2 EA.	3125	6250	32	64	25-	1600			7850
R. 15-3	PUMP, CENTRIF. 456GPM, 7.5HP	2 EA	2920	5840	32	64	25-	1600			7440
M.151.851.0730	PIPE, INSULATED CONDUIT, 4"	60 LF	23.50	1410	.72	43	25-	1080			2490
.0720	" " " , 3"	6820 LF	18.90	128900	.57	3887	25-	97180			226080
.0710	" " " , 2-1/2"	960 LF	16.30	15650	.47	451	25-	11280			26930
.0700	" " " , 2"	100 LF	16.10	1610	.38	38	25-	950			2560
R.2-14, 2-17, 2-21	TRENCH & BACKFILL, 24"x36"	3970 LF							2.81	11160	11160
M.020, .025	PAVEMENT REMOVE & REPLACE	400 SF							5.93	2370	2370
M.151.701.2120	PIPE, BLK STEEL + FTTGS, 5"	100 LF	12.58	1260	0.5	50	25-	1250			2510
—	EXPANSION TANK & FILL STA.	1 LS	525	525	5.0	25	125-				650
M.033.130.4701	CONCRETE PAD FOR TOWER	6 CY							100	600	600
M.051.110.0010	MISC. STEEL " "	4000 LBS	.75	3000	.007	28	25-	700			3700
M.970.0010	STEEL BUILDING, 20'x30'x12'	600 SF.							30-	18000	18000
M.151.960.1070	VALVE, B'FLY, CL 150, 5"	2 EA	115	230	4.8	9.6	25-	240			470
.1060	" " " " 4"	4 EA	90	360	3.2	12.8	25-	320			680
—	INTERCONNECT @ EA BLDG.	4 EA	7000	28000	280	1120	25-	28000			56000
M.157.401.1200	ETHYLENE GLYCOL	900 GAL	5.90	5310	0.01	9	25	230			5540
	TOWER WATER TREATMENT.										
											447,660

* R = RICHARDSON ESTIMATING GUIDE, M = MEANS ESTIMATING GUIDE

D18-45

E M C ENGINEERS, INC.
Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX # 38
ALT. # 1B

JOB WSMR ESOS STUDY # 1110.000
SHEET NO. ______ OF ______
CALCULATED BY C. Butler DATE 3-11-92
CHECKED BY ______ DATE ______
SCALE ______

A. WATER-COOLED CENTRIFUGAL SERVING 23640, 23642, 23638 & 24072

1. EVAPORATOR:

USING APPLICABLE DATA FROM ALT. # 1A:

GPM = 342
HEAD = 145 + 15 + 50 = 210'
CAPY = 152.0 TONS R.

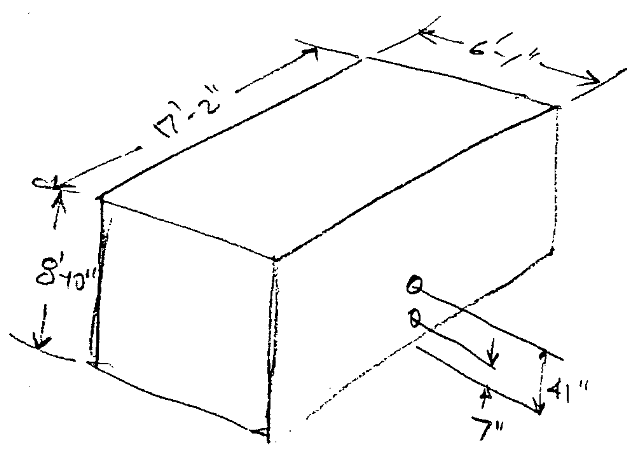
2. CONDENSER:

GPM = 152.0 TONS R. × 3.0 GPM/TON. = 456 GPM
HEAD:

STATIC: 10'
P.D. COND.: 20'
30'

PUMP HP = 1.2 × 456 × 30 / 3960 × 0.7 = 5.92 SAY 7.5 HP.

3. COOLING TOWER SELECTION:
(SEE ATTACHED BAC SELECTION SHEET)



WITH 10 HP FAN MOTOR.

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

JOB

SHEET NO. OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

GPM	SIZE	P.D.'/100 LF	LENGTH	P.D.	CUM. P.D.
53	2-1/2"	2.13	5430	115.66	
	3"	0.736	"	39.965	say 40

40
+ 15
+ 50
105' compares w/ P.D. in alt. 2A.

TRANE SERIES R SELECTION PROGRAM Version 11.12

INPUT FILE NAME : C:\JOBS\EMC\WHITE\RTHA.FRE
PROJECT : WHITE SANDS PROJECT
LOCATION : NEW MEXICO
BUILDING OWNER :
'ROGRAM USER : RCH
COMMENT : FOR CHET BUTLER
EPS FLAG : Y

***** INPUT CONDITIONS ***

MACHINE TAG	1-B	MOTOR KW SIZE	
COMPRESSOR SIZE	150	VOLTAGE	460
SHELL TYPE	LONG	FREQUENCY	60
DESIGN DUTY		MAX KW/TONS	
DESIGN KW		REFRIGERANT	22
EG			
EXITING EVAP TEMP	42	ENTERING COND TEMP	80
EVAP FLOW RATE		COND FLOW RATE	
ENTERING EVAP TEMP	55	EXITING COND TEMP	95
EVAPORATOR PASSES	3	CONDENSER PASSES	2
EVAP FOULING FACTOR	0.00025	COND FOULING FACTOR	0.00025
MAX EVAP PRESSURE DROP		MAX COND PRESSURE DROP	
BUILT BY	PUEBLO	COND TUBE TYPE	STD
BRINE TYPE	EG	BRINE TYPE	
BRINE %	30	BRINE %	0

***** OUTPUT DATA **

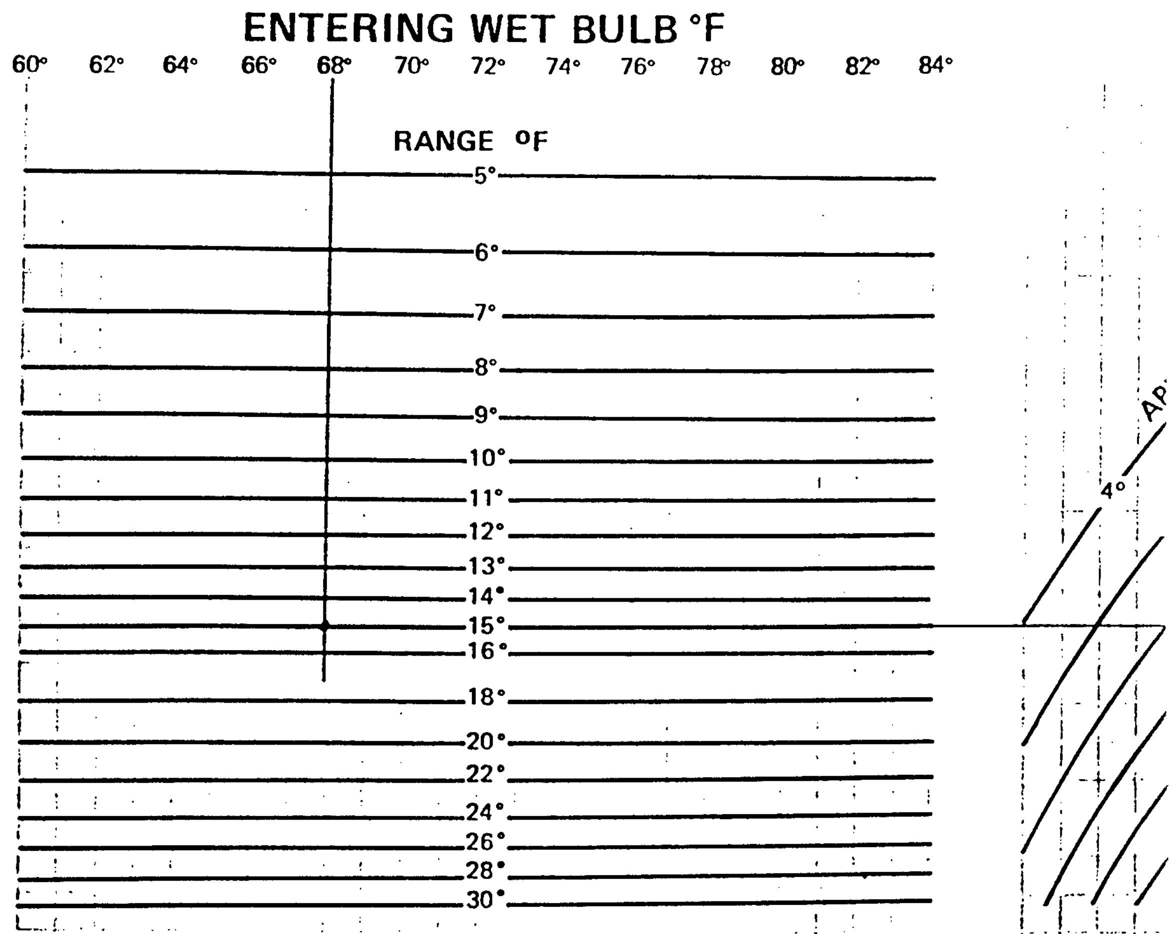
NOTE - RATING OUTSIDE THE SCOPE OF THE ARI CENTRIFUGAL AND ROTARY WATER CHILLERS CERTIFICATION PROGRAM.

MODEL RTHA	150
SHELL LENGTH	LONG
DESIGN DUTY	145 TONS
POWER CONSUMED	109 KW
KW PER DESIGN DUTY	0.75
EXIT EVAP TEMP	42.0 F
EVAP FLOW RATE	293 GPM
ENTERING EVAP TEMP	55.0 F
EVAPORATOR PASSES	3
EVAP PRESSURE DROP	17 FEET
EVAP FOULING FACTOR	0.00025
EVAP BRINE TYPE	EG
EVAP BRINE PERCENT	30
EVAP BRINE FREEZE PT	5.1 F
ENTERING COND TEMP	80.0 F
COND FLOW RATE	282 GPM
EXIT COND TEMP	95.0 F
CONDENSER PASSES	2
COND PRESSURE DROP	9 FEET
COND FOULING FACTOR	0.00025
COND BRINE TYPE	WATER
COND BRINE PERCENT	0
COND TUBE TYPE	STANDARD
NOMINAL MOTOR KW	121 KW
MAX LRA AT NOMINAL MOTOR KW	803 AMPS
RLA AT MOTOR KW	170 AMPS
RLA AT SELECTION KW	151 AMPS

D18-48

SHIP WEIGHT	5857 LBS
OPERATING WEIGHT	6290 LBS

SERIES 3000 SELECTION CHART



STEP-BY-STEP PROCEDURE FOR SELECTING A SERIES 3000 COOLING TOWER

GPM 456 Water In 95 * °F Water Out 80 °F Wet Bulb 68 °F
*Do not exceed 120°F

1. **Determine Range:** Water In 95 °F − Water Out 80 °F = 15 °F = Range
2. **Determine Approach:** Water Out 80 °F − Water Bulb 68 °F = 12 °F = Approach
3. **Determine Selection Factor**

   Entering at the design Wet Bulb temperature, project a line vertically downward to intersect the Range determined above. From this point project a horizontal line to the right intersecting the Approach curve at that temperature determined above. Then project a line vertically downward to intersect the design Wet Bulb line. Read the Selection Factor at this point.

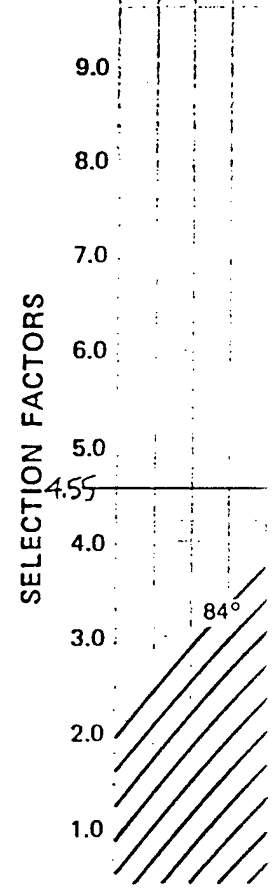
   Selection Factor = 4.5 - 4.6

4. **Select Unit**

   Turn to the Series 3000 Capacity Tables on page 10 which tabulate the tower capacities in USGPM for Selection Factors ranging from 0.50 to 9.00. To select a tower, enter the table and read across the Selection Factor line to a factor EQUAL TO OR JUST LESS THAN the factor determined in Step 3. Read down the column until reaching a flow rate EQUAL TO OR GREATER THAN the design flow. Read the tower model number from the column on the left. If desired, the exact flow capacity can be found by interpolating directly between listed selection factors.

   If the required flow rate exceeds all values shown in Table 1 (single cell units) for the appropriate Selection Factor, repeat the procedure using Table 2 (Double Cell units). Selection of three or more cells can be obtained by dividing the required flow rate by the number of cells required and utilizing Table 1.

FINAL SELECTION IS MODEL 3165

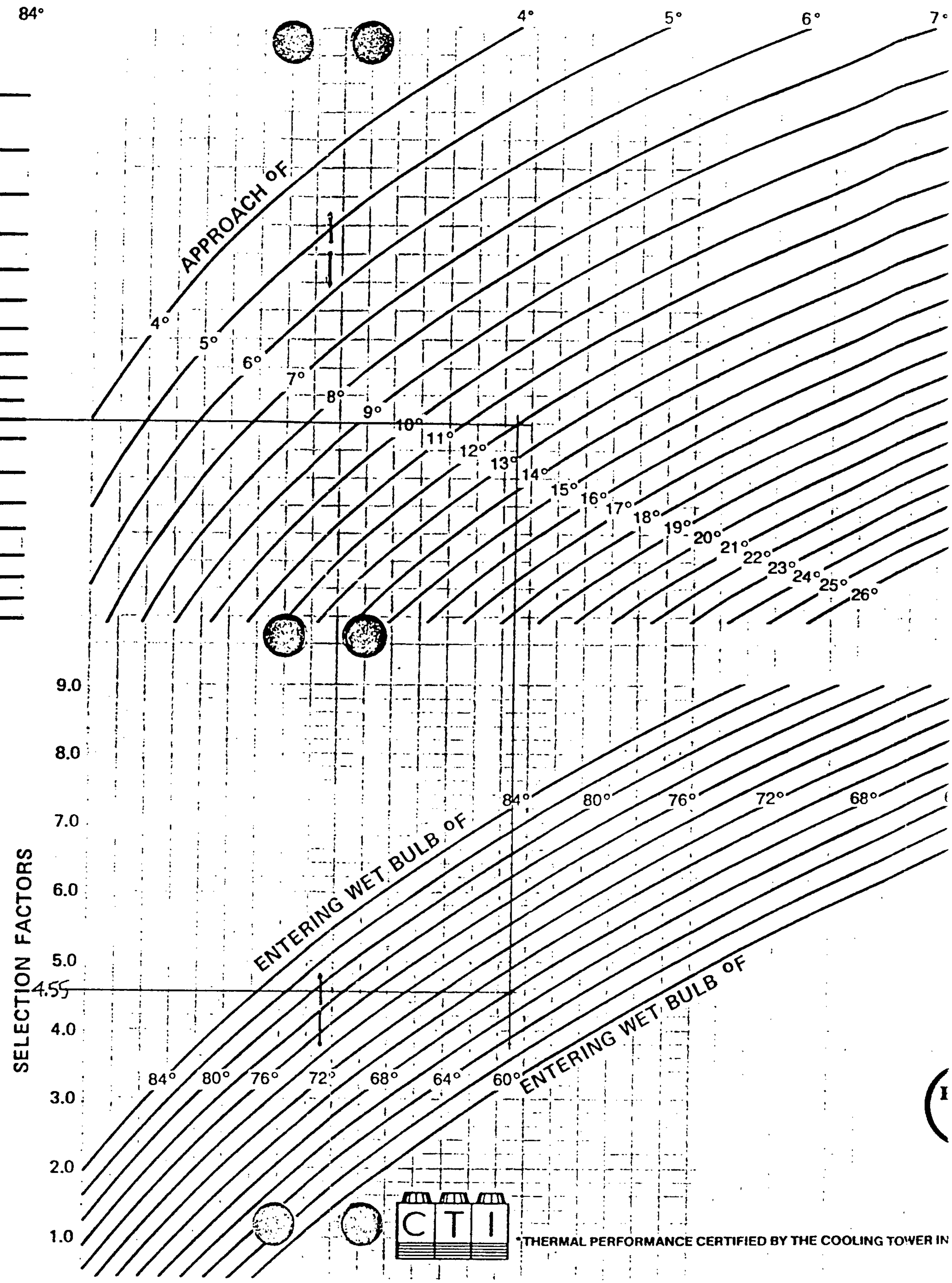


1

HART

.B °F

° 78° 80° 82° 84°



S 3000

'et Bulb 68 °F

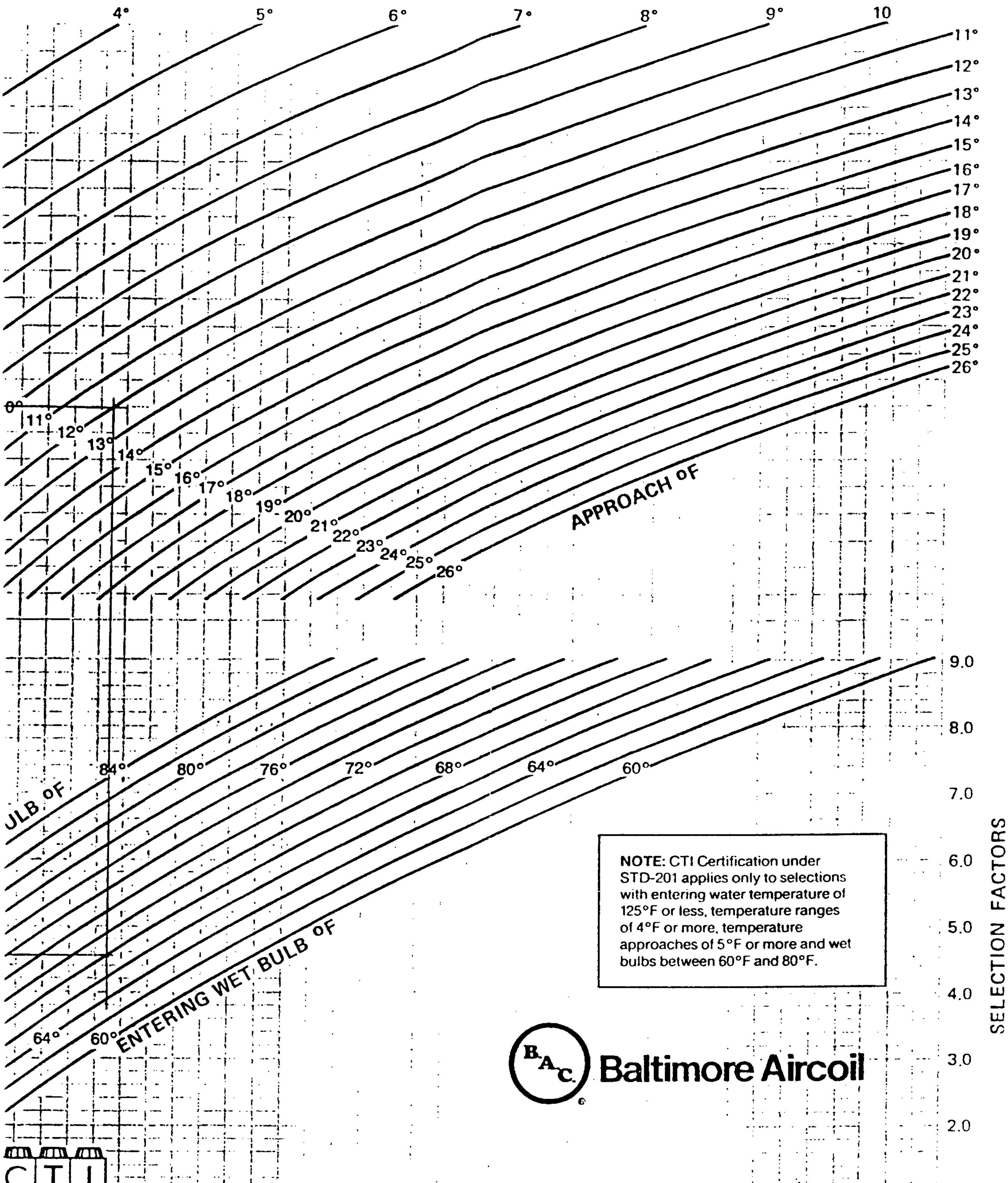
15 °F = Range

_ °F = 12 °F =

to intersect the Range
secting the Approach
nward to intersect the

capacities in USGPM
le and read across the
determined in Step 3.
THAN the design flow.
t flow capacity can be

s) for the appropriate
ction of three or more
required and utilizing



*THERMAL PERFORMANCE CERTIFIED BY THE COOLING TOWER INSTITUTE (CTI) IN ACCORDANCE WITH CTI STANDARD STD-201

3

* Mark owned by the Cooling Tower Institute

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 LC-38 ALT 1B

---------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	77,998	187	1,318	35	2
Feb	70,434	188	982	31	1
March	79,638	193	250	33	0
April	78,850	207	0	43	0
May	94,817	230	0	132	0
June	103,324	254	0	199	0
July	110,784	264	0	235	0
Aug	110,542	255	0	213	0
Sept	94,750	234	0	127	0
Oct	85,112	206	4	44	0
Nov	75,008	190	484	33	1
Dec	77,158	188	1,060	34	1
Total	1,058,413	264	4,098	1,158	2

Building Energy Consumption = 44,978 (Btu/Sq Ft/Year)   Floor Area = 89,425 (Sq Ft)
Source Energy Consumption = 126,023 (Btu/Sq Ft/Year)

Σ monthly KW FOR CHILLER PLANT = 823

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 B

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
0	LIGHTS														
	ELEC	33925	30704	35385	32706	34655	34068	33293	35385	32706	34655	32509	33293		403,284
	PK	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1		108.1
1	MISC LD														
	ELEC	17742	16039	18152	17125	17947	17516	17556	18152	17125	17947	17087	17556		209,946
	PK	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6		40.6
2	MISC LD														
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060		4,098
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4		1.8
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ1500	TRANE SERIES R CTV >200 TONS													
	ELEC	10323	9234	10093	11011	19849	27620	35011	32082	20800	11302	9920	10301		207,547
	PK	17.1	18.6	22.2	29.3	49.7	72.0	81.7	72.5	51.4	28.7	19.8	18.0	481	81.7
1	EQ5100	COOLING TOWER													
	ELEC	0	0	0	2517	6358	8628	8916	8916	8628	5201	0	0		49,164
	PK	0.0	0.0	0.2	12.0	12.0	12.0	12.0	12.0	12.0	12.0	0.0	0.0	84	12.0
1	EQ5100	COOLING TOWER													
	WATER	35	31	33	43	132	199	235	213	127	44	33	34		1,158
	PK	0.1	0.1	0.1	0.2	0.4	0.5	0.5	0.5	0.4	0.2	0.1	0.1	~~178.8~~	0.5
1	EQ5001	CHILLED WATER PUMP C.V.													
	ELEC	11100	10026	11100	10742	11100	10742	11100	11100	10742	11100	10742	11100		130,699
	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	178.8	14.9
1	EQ5010	CONDENSER WATER PUMP C.V.													
	ELEC	4163	3760	4163	4028	4163	4028	4163	4163	4028	4163	4028	4163		49,012
	PK	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	67.2	5.6

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 B

Chiller Controls

√ ELEC	744	672	744	720	744	720	744	744	720	744	720	744		8,760
PK	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12	1.0

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1 13

---------- U T I L I T Y   P E A K   C H E C K S U M S ----------

Utility ELECTRIC DEMAND

Peak Value 263.9 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1500	TRANE SERIES R CTV >200 TONS	115.2	43.68
Sub Total			115.2	43.68
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			108.1	40.95
Base Utilities			0.0	0.00
Misc Equipment			40.6	15.37
Sub Total			148.6	56.32
Grand Total			263.9	100.00

E M C ENGINEERS, INC.
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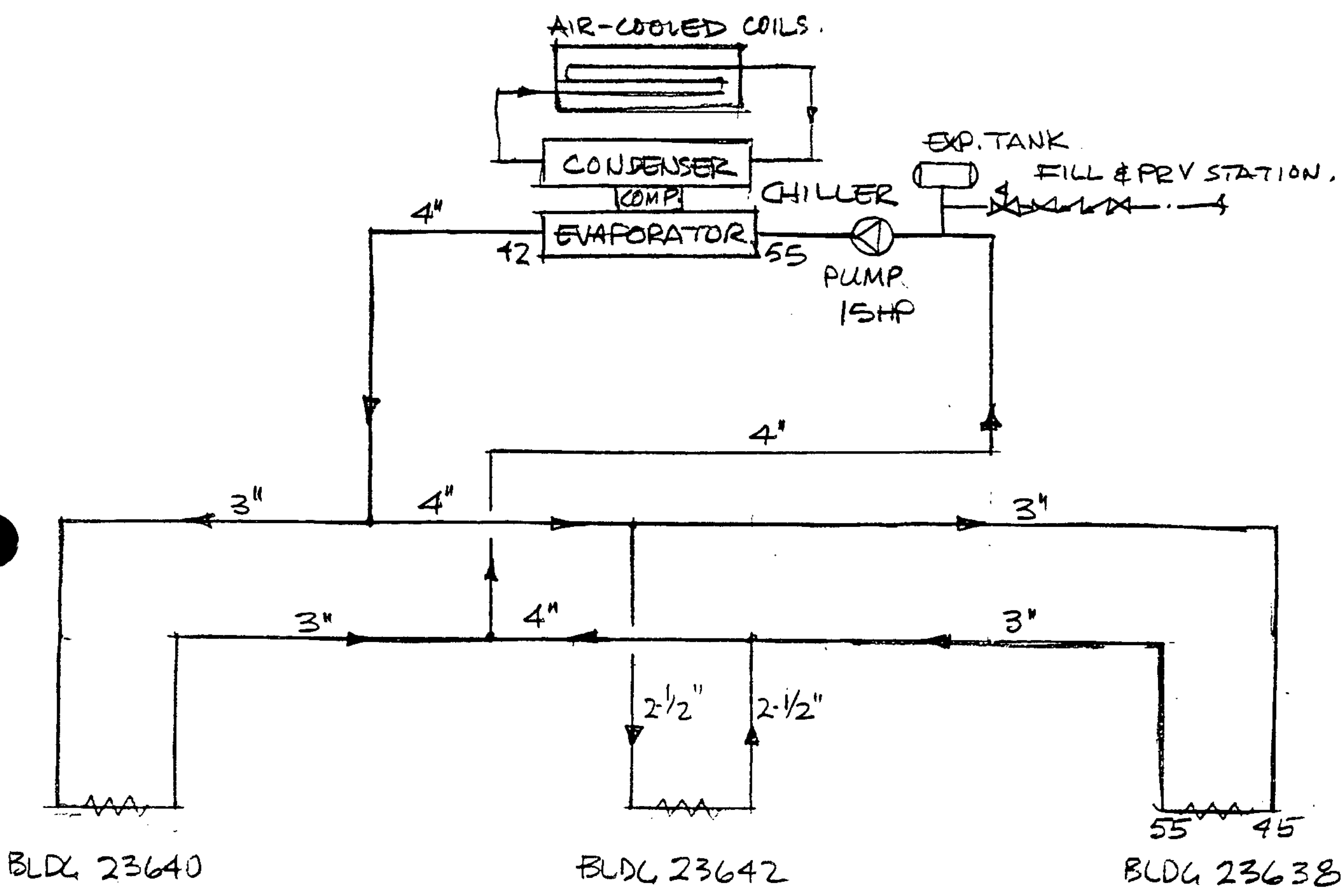
JOB WSMR ESOS STUDY #1110.000
SHEET NO. 1 OF 1
CALCULATED BY C. Butler DATE 3.6.92
CHECKED BY ______ DATE ______
SCALE ______

LAUNCH COMPLEX #38
ALT # 2A

SCHEMATIC



LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range | REGION: 4 | PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: LAUNCH COMPLEX 38 - CHILLER PLANT STUDY - ALT. 2A | FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/24/92 | ECONOMIC LIFE: 25 | PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=		$325,091	
B. SIOH COST	(5.5% of 1A) =		$17,880	
C. DESIGN COST	(6.0% of 1A) =		$19,505	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$362,477	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D - 1E) =		----------->	$362,477

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	3,974	$25,751	15.23	$392,193	
B. DIST		0	$0	17.28	$0	
C. PROPANE	$6.71	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		3,974	25,751.3		----------->	$392,193

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) + (ANNUAL RECURRING MAINTENANCE COST) = $1,547

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $22,708

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$283,750	1	0.96	$272,400
b. EQUIP REPLACEMENT COST	$0	5	0.80	$0
c.	$0		0.00	$0
d TOTAL	$283,750			$272,400

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $295,108

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $129,424

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 1.44

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = $38,648

5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = $687,301

6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 1.90

(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)

7 SIMPLE PAYBACK (SPB) (1F/4) = 9.38

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): LAUNCH COMPLEX 38 (ALT 2A)

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS	EA	1	58500.00	58500	64.00	35.81	2291.84		$60,791.84
	PUMP, CENTRIF, 273 GPM, 15 HP	EA	2	2770.00	5540	32.00	35.81	2291.84		$7,831.84
	PIPE, INSULATED CONDUIT, 4"	LF	240	23.50	5640	0.72	35.81	6187.97		$11,827.97
	PIPE, INSULATED CONDUIT, 3"	LF	2260	18.90	42714	0.57	35.81	46130.44		$88,844.44
	PIPE, INSULATED CONDUIT, 2-1/2"	LF	100	16.30	1630	0.47	35.81	1683.07		$3,313.07
	TRENCH & BACKFILL, 24"x36"	LUMP SUM	1300 LF	2.81	3653					$3,653.00
	PAVEMENT, REMOVE & REPLACE	LUMP SUM	260 SF	7.00	1820					$1,820.00
	EXPANSION TANK & FILL STA.	LS	1	455.00	455	5.00	35.81	179.05		$634.05
	CONCRETE PAD FOR CHILLER	LUMP SUM	7.5 CY	100.00	750					$750.00
	PUMP HOUSING, PREFAB METAL	LUMP SUM	100 SF	30.00	3000					$3,000.00
	VALVE, BFLY, CL 150, 4"	EA	4	90.00	360	3.20	35.81	458.37		$818.37
	INTERCONNECT @ EA BLDG.	EA	3	7000.00	21000	280.00	35.81	30080.40		$51,080.40
	ETHYLENE GLYCOL	GAL	330	5.90	1947	0.01	35.81	118.17		$2,065.17
	SUBTOTAL									$236,430.15
	OVERHEAT & PROFIT (25%)									$59,107.54
	CONTINGENCY (10%)									$29,553.77
	TOTAL THIS SHEET									$325,091.46

ESTIMATE SUMMARY

PROJECT: WSMR ESOS STUDY #1110.000
LAUNCH COMPLEX #38

ESTIMATE NO. ALT. 2A
SHEET NO. 1
PREPARED BY: C. Butler DATE: 3·16·92
CHECKED BY: DATE:

MAIN ACCOUNT	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M.H.	TOTAL M.H.	RATE	AMOUNT	UNIT PRICE	AMOUNT	
R. 15-1	CHILLED WTR GEN. AIR-COOLED 140 T (NOM), W/CONTROLS.	1 EA.	58500	58500	64	64	25	1600			60100
R. 15-3	PUMP, CENTRIF, 273 GPM, 15 HP	2 EA.	2770	5540	32	64	25	1600			7140
M.151·851·0730	PIPE, INSULATED CONDUIT, 4"	240 LF	23.50	5640	.72	173	25	4320			9960
·0720	" " " , 3"	2260 LF	18.90	42710	.57	1288	25	32200			74910
·0710	" " " , 2-1/2"	100 LF	16.30	1630	.47	47	25	1180			2810
R.2-14,2-17,2-21	TRENCH & BACKFILL, 24"x36"	1300 LF							2.81	3650	3650
M. 020,025	PAVEMENT, REMOVE & REPLACE	260 SF							7	1820	1820
—	EXPANSION TANK & FILL STA.	1 LS	455	455	5	5	25	125			580
M.033·130·4701	CONCRETE PAD FOR CHILLER	7.5 CY							100	750	750
M·970·0010	PUMP HOUSING, PREFAB METAL	100 SF							30	3000	3000
M.151-960-1060	VALVE, BFLY, CL 150, 4"	4 EA	90	360	3.2	12.8	25	320			680
—	INTERCONNECT @ EA BLDG	3 EA	7000	21000	280	840	25	21000			42000
M.157·401·1200	ETHYLENE GLYCOL	330 GAL	5.90	1950	0.01	3.3	25	80			2030
											209,430

JOB LAUNCH COMPLEX 38

E M C ENGINEERS, INC.

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SHEET NO. ______ OF ______

CALCULATED BY ______ DATE ______

CHECKED BY ______ DATE ______

SCALE ______

2A. AIR-COOLED BLDGS. 23640, 23642 & 23638

15 HP CIRC. PUMP.

RTAA 140

5 - 1.5 HP COND. FANS.

$$\left.\begin{array}{l}23638\\23640\\23642\end{array}\right\} \Sigma KW = 2{,}667 \quad \Sigma KWH = 830{,}127$$

24072 $\Sigma KW = 724$ $\Sigma KWH = 438{,}375$

TOTAL $\Sigma KW = 3{,}391$ $\Sigma KWH = 1{,}268{,}502$ $128,069 /yr.

ANNUAL MNTCE COST: CENT. PLANT $

24072 $

TOTAL $ /yr.

CONSTRUCTION COST $

2B WTR COOLED " " " ,

15 HP CIRC PUMP

5 HP COND PUMP.

RTHA 130

5 HP COOL'G TWR FAN.

TRANE

PROPOSAL

The Trane Company
A Division of American Standard Inc.

Number WHITE

> WATER COOLED SERIES R CENTRAVAC
> 150 NOMINAL TONS
> 460V/60/3
> LONG LENGTH SHELLS
> 3 PASS EVAPORATOR, 150 PSI EVAPORATOR WATER PRESSURE
> 2 PASS CONDENSER, 150 PSI CONDENSER WATER PRESSURE
> UL LISTED
> UNIT MOUNTED, STAR DELTA STARTER W/ DISCONNECT, VOLT & AMMETERS
> FACTORY INSULATION
> FLOW SWITCHES
> FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS B TO B .... $ 55,800

ITEM: C QTY: 1 DESCRIPTION: TRANE ROTARY AIR COOLED CHILLER
TAG (S):
2-A

> Air Cooled Series R Chiller
> 140 Tons NOMINAL
> 460V/60/3
> Y Delta Closed Transition Starter w/ Disconnect Switch
> U.L. Listing
> Deluxe Controller
> Architectural Louvered Panels
> Control Power Transformer
> 150 PSI Flow Switch
> FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS C TO C .... $ 58,500

ITEM: D QTY: 1 DESCRIPTION: TRANE ROTARY CHILLER
TAG (S):
2-B

> WATER COOLED SERIES R CENTRAVAC
> 130 NOMINAL TONS
> 460V/60/3
> LONG LENGTH SHELLS
> 3 PASS EVAPORATOR, 150 PSI EVAPORATOR WATER PRESSURE
> 2 PASS CONDENSER, 150 PSI CONDENSER WATER PRESSURE

TRANE™ **PROPOSAL**

WHITE

Number 3

Page

The Trane Company
A Division of American Standard Inc.

> UL LISTED
> UNIT MOUNTED, STAR DELTA STARTER W/ DISCONNECT, VOLT & AMMETERS
> FACTORY INSULATION
> FLOW SWITCHES
> FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS D TO D .... $ 47,100

RESPECTFULLY SUBMITTED,

RCH

ROGER C. HUBERT
SALES ENGINEER

JOB WSMR ESOS STUDY # 1110.000

SHEET NO. 1 OF 5

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY C. Butler DATE 3.4.92

CHECKED BY DATE

SCALE

LAUNCH COMPLEX #38
ALT. # 2A

ALT. # 2A AIR-COOLED COLD GENERATOR SERVING 23640, 23642 & 23638

A. @ 2.4 GPM/TON R.; GPM FLOWS TO EA. BLDG ARE:

1. BLDG. 23640: 2.4 GPM/TON × 36.2 $TON_{DESIGN\ PK}$ = 87 GPM
   87 GPM THRU 3" BLK STL PIPE: 3.8 fps & 1.83'/100 LF.
2. BLDG. 23642: 2.4 GPM/TON × 32.3 $TON_{DESIGN\ PK}$ = 78 GPM.
   78 GPM THRU 2 1/2" BLK STL PIPE: 5.2 fps & 4.42'/100 LF.
3. BLDG. 23638: 2.4 GPM/TON × 45 $TON_{DESIGN\ PK}$ = 108 GPM.
   108 GPM THRU 3 BLK STL PIPE: 4.7 fps & 2.75'/100 LF
4. BLDGS 23642 & 23638: 78 + 108 = 186 GPM.
   186 GPM THRU 4" BLK STL PIPE: 4.7 fps & 1.97'/100 LF
5. ALL BLDS: 87 + 78 + 108 = 273 GPM
   273 GPM THRU 4" BLK STL PIPE: 6.9 fps & 4.10'/100 LF.

B. LENGTHS OF PIPE:

2-1/2": 50 LF S & R = 100 LF.

3": 1130 LF S & R = 2260 LF.

4": 120 LF S & R = 240 LF.

C. ESTIMATED PUMP HEAD:

650' @ 2.75'/100 LF	= 17.875 × 2	≅	36.0'
90' @ 1.97'/100 LF	= 1.773 × 2	≅	3.2'
30' @ 4.10'/100 LF	= 1.230 × 2	≅	2.5'
			41.7
+ 10% FITTINGS	=		4.2
+ CHILLER P.D.			10.0
+ EST. BLDG P.D.			50.0
			105.9 SAY 106'

JOB WSMR ESOS STUDY # 1110 · 000

SHEET NO. 2 OF 5

E M C ENGINEERS, INC.

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CALCULATED BY C. Butler DATE 3.4.92

CHECKED BY DATE

LAUNCH COMPLEX # 38
ALT. # 2A

SCALE

D. ESTIMATED PUMP HORSEPOWER:

$$BHP = \frac{GPM \times HD \times SPGR}{3960 \times eff.} = \frac{273 \times 106 \times 1.04}{3960 \times 0.70} = 10.86$$

MOTOR HP = 10.86 + 20% = 13.03 USE 15 HP

E. CHILLER SELECTION:

TOTAL CAPY: (DESIGN PK)

BLDG	23640	32.3
BLDG	23642	36.2
BLDG	23638	45.0
		113.5 TON R.

@ 115° AMB TEMP.
~ 4000' ELEV.
30% GLYCOL SOLN (BY WT.)

FROM ATTACHED PERFORMANCE ADJUSTMENT CHARTS:

FOULING FACTOR = .00025 & 4000' ELEV. CAPY = × 0.960 KW = × 1.03

FOR 30% BRINE SOLN: CAPY = × 0.975 KW = × 0.988

CAPY ADJUSTED:

$$\frac{113.5}{0.960 \times 0.975} = 121.3 \text{ TON R.}$$

JOB WSMR ESOS STUDY #1110.000

SHEET NO. 3 OF 5

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY C. Butler DATE 3.6.92

CHECKED BY ______ DATE ______

SCALE ______

LAUNCH COMPLEX 38
ALT. # 2A

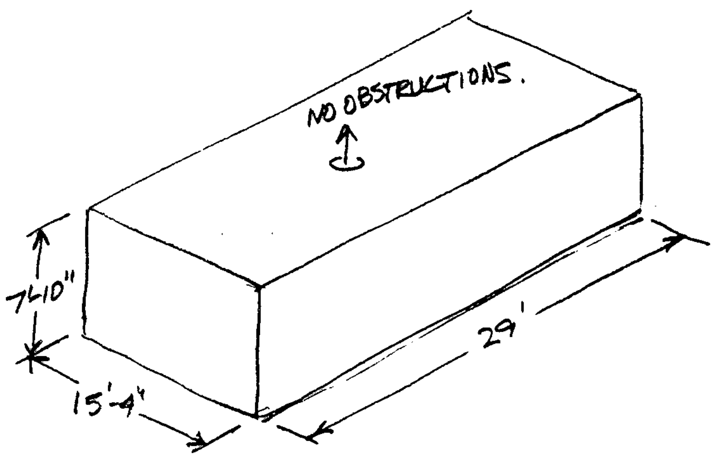
F. AIR-COOLED COLD GENERATOR SELECTION:

SELECT A TRANE RTAA 140. @ COND AIR TEMP = 115°F, LWT 42°*

CAP'Y = 127.4 TON R. ←

KW = 202.5 × CORRECTIONS = 202.5 × .99 × 1.03 = 206.5 ← (1.62 KW/T.)

* LWT @ 42° ALLOWS FOR 2-3°F PICK-UP IN CIRCULATING PIPING.



DIM'S INCLUDE WORKING CLEARANCE AROUND MACHINE.

TRANE

WSMR ESOS STUDY #1110.000
SHEET 4 OF 5
C. BUTLER 3.6.92
LAUNCH COMPLEX #38
ALT. #2A

Performance Adjustment Factors

Table 19-1 — Performance Data Adjustment Factors

Fouling Factor	Chilled Water ΔT	Sea Level CAP	Sea Level GPM	Sea Level KW	2000 Feet CAP	2000 Feet GPM	2000 Feet KW	4000 Feet CAP	4000 Feet GPM	4000 Feet KW	6000 Feet CAP	6000 Feet GPM	6000 Feet KW
0.00025	6	0.987	1.650	0.993	0.967	1.640	1.003	0.952	1.620	1.019	0.932	1.570	1.029
	8	0.993	1.250	0.997	0.973	1.240	1.007	0.956	1.220	1.025	0.935	1.190	1.035
	10	1.000	1.000	1.000	0.980	0.990	1.010	0.960	0.970	1.030	0.940	0.940	1.040
	12	1.007	0.820	1.003	0.987	0.810	1.013	0.966	0.800	1.035	0.945	0.780	1.045
	14	1.013	0.710	1.007	0.993	0.700	1.017	0.972	0.680	1.038	0.952	0.660	1.048
	16	1.020	0.640	1.010	1.000	0.630	1.020	0.980	0.620	1.040	0.960	0.600	1.050
0.00075	6	0.967	1.630	0.983	0.958	1.610	0.993	0.938	1.590	1.002	0.918	1.550	1.012
	8	0.973	1.230	0.987	0.964	1.220	0.997	0.944	1.200	1.005	0.925	1.180	1.016
	10	0.980	0.980	0.990	0.970	0.970	1.000	0.950	0.950	1.010	0.930	0.930	1.020
	12	0.987	0.800	0.993	0.975	0.800	1.003	0.955	0.780	1.015	0.934	0.770	1.026
	14	0.993	0.690	0.997	0.978	0.680	1.007	0.958	0.660	1.022	0.937	0.650	1.032
	16	1.000	0.620	1.000	0.980	0.610	1.010	0.960	0.600	1.030	0.940	0.590	1.040

Figure 19-1 — Ethylene Glycol Performance Adjustment Factors and Solution Freezing Points

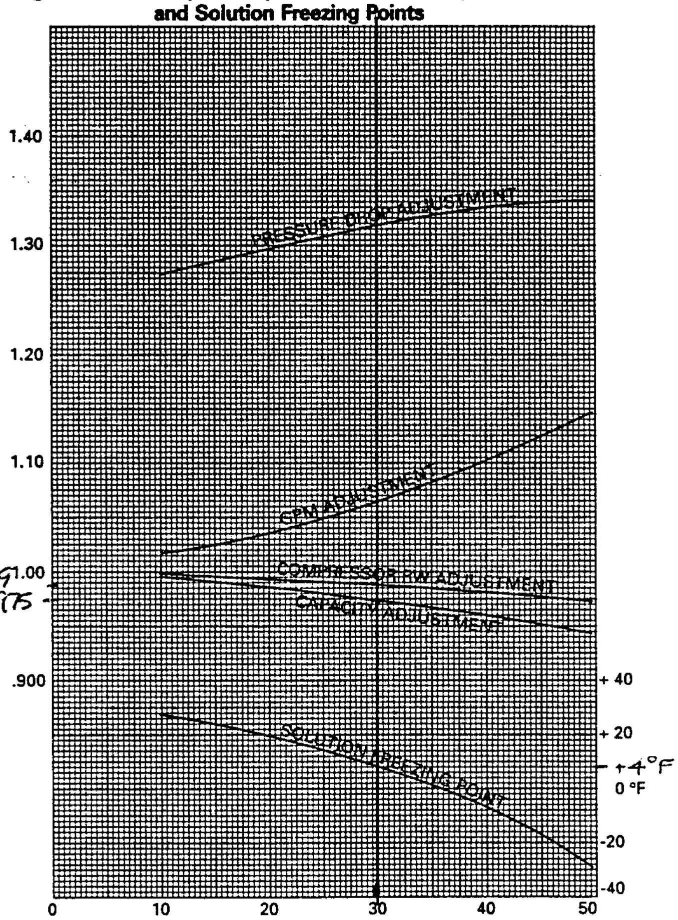
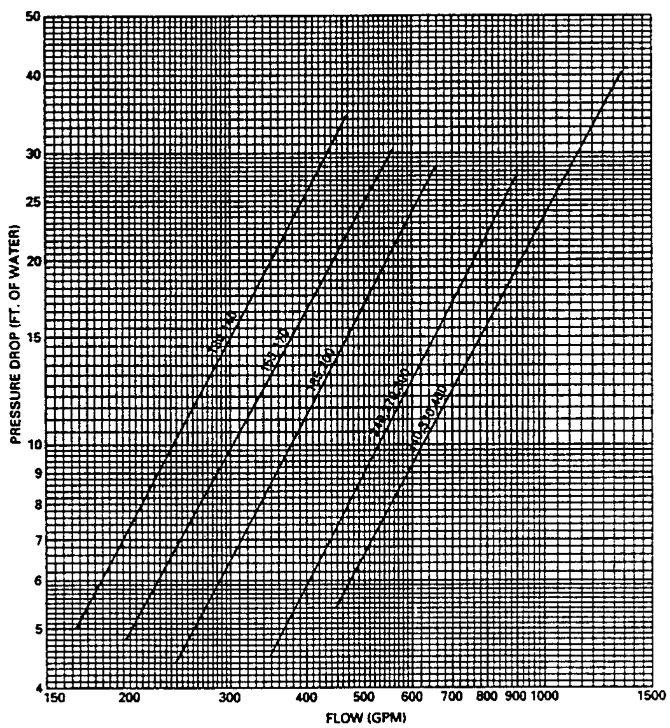


Figure 19-2 — Evaporator Water Pressure Drop



TRANE

Performance Data

WSMR ESOS STUDY #1110.000
SHEET 5 OF 5
CBUTLER 3.6.92
LAUNCH COMPLEX # 38
ALT. # 2A

Table 20-1 — RTAA 130 Performance Data

LWT	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER
40	147.5	122.4	13.0	139.7	135.1	11.3	131.6	149.7	9.7	123.1	166.3	8.2	114.3	185.0	6.9
42	152.6	124.5	13.2	144.6	137.2	11.5	136.2	151.9	9.9	127.5	168.6	8.4	118.3	187.3	7.1
44	157.8	126.6	13.5	149.6	139.4	11.7	141.0	154.2	10.1	131.9	170.9	8.6	122.5	189.7	7.3
45	160.5	127.6	13.6	152.1	140.5	11.9	143.4	155.3	10.2	134.2	172.1	8.7	124.6	190.9	7.3
46	163.2	128.7	13.7	154.7	141.6	12.0	145.8	156.5	10.3	136.4	173.3	8.8	126.7	192.1	7.4
48	168.6	130.9	14.0	159.9	143.9	12.2	150.7	158.8	10.5	141.0	175.8	9.0	130.7	194.7	7.6
50	174.1	133.2	14.2	165.1	146.3	12.4	155.6	161.3	10.7	145.7	178.3	9.1	129.9	186.9	7.8
55	188.3	139.1	14.8	178.7	152.4	12.9	168.4	167.7	11.2	157.7	184.9	9.6	135.4	182.3	8.3

Table 20-2 — RTAA 140 Performance Data

LWT	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER
40	159.4	132.4	13.1	150.9	146.1	11.3	142.0	161.9	9.7	132.7	179.8	8.3	123.1	199.9	6.9
42	164.9	134.6	13.3	156.2	148.5	11.6	147.0	164.4	9.9	137.4	182.3	8.4	127.4	202.5	7.1
44	170.5	136.9	13.6	161.5	150.9	11.8	152.0	166.8	10.1	142.1	184.9	8.6	124.5	190.5	7.3
45	173.3	138.1	13.7	164.2	152.1	11.9	154.5	168.1	10.2	144.5	186.2	8.7	126.7	191.7	7.4
46	176.2	139.3	13.8	166.9	153.3	12.0	157.1	169.4	10.3	146.9	187.6	8.8	127.0	189.3	7.5
48	182.0	141.8	14.0	172.4	155.9	12.2	162.3	172.0	10.5	151.7	190.3	9.0	129.5	188.1	7.7
50	187.9	144.3	14.3	178.0	158.5	12.4	167.6	174.8	10.7	156.7	193.1	9.1	132.1	186.8	7.9
55	203.0	150.8	14.8	192.3	165.3	12.9	181.1	181.9	11.1	169.3	200.5	9.5	135.3	177.9	8.5

Table 20-3 — RTAA 155 Performance Data

LWT	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER
40	166.4	140.2	12.9	158.0	155.0	11.2	149.3	171.8	9.6	140.0	190.6	8.2	130.4	211.5	6.9
42	172.5	142.6	13.1	163.9	157.5	11.4	154.8	174.4	9.8	145.2	193.3	8.4	135.2	214.2	7.1
44	178.8	145.1	13.4	169.8	160.1	11.7	160.4	177.0	10.0	150.5	196.0	8.6	134.6	205.9	7.3
45	181.9	146.3	13.5	172.8	161.4	11.8	163.2	178.4	10.2	153.1	197.4	8.7	137.0	207.2	7.4
46	185.1	147.6	13.7	175.9	162.7	11.9	166.1	179.7	10.3	155.8	198.8	8.8	138.0	205.8	7.5
48	191.5	150.2	13.9	182.0	165.3	12.1	171.9	182.5	10.5	161.3	201.6	9.0	137.0	197.5	7.7
50	198.1	152.8	14.2	188.3	168.1	13.4	177.8	185.3	10.7	166.8	204.5	9.1	137.2	191.8	8.0
55	214.9	159.6	14.8	204.3	175.2	12.9	193.0	192.7	11.2	181.0	212.2	9.6	136.1	175.5	8.6

Table 20-4 — RTAA 170 Performance Data

LWT	Entering Condenser Air Temperature (Degrees F)														
	75			85			95			105			115		
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER
40	184.0	157.4	12.7	174.7	172.9	11.1	165.2	190.7	9.6	155.5	210.8	8.2	133.6	210.5	7.1
42	190.3	160.3	12.9	180.7	175.8	11.3	171.0	193.7	9.8	161.0	214.0	8.4	132.0	201.1	7.3
44	196.8	163.2	13.2	186.9	178.9	11.5	176.8	196.8	10.0	166.5	217.2	8.6	131.0	192.8	7.5
45	200.0	164.7	13.3	190.0	180.4	11.6	179.8	198.4	10.1	169.3	218.8	8.7	130.8	190.6	7.6
46	203.3	166.2	13.4	193.1	182.0	11.7	182.7	200.0	10.2	172.1	220.5	8.7	131.0	188.0	7.7
48	210.0	169.2	13.6	199.5	185.1	11.9	188.8	203.3	10.3	177.8	223.9	8.9	131.2	182.6	8.0
50	216.7	172.4	13.8	205.9	188.4	12.1	194.9	206.7	10.5	183.6	227.4	9.1	131.4	177.0	8.2
55	234.1	180.6	14.3	222.5	196.8	12.6	210.7	215.4	10.9	198.5	236.5	9.5	133.7	166.1	8.8

Notes:
1. Ratings based on sea level altitude and evaporator fouling factor of 0.00025 per ARI 550-90.
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. KW input is for compressors only.
4. 44 F LWT, 95 F entering air temperature represents ARI rating point.
5. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
6. Ratings are based on an evaporator temperature drop of 10 F.
7. 115 F Performance data reflects Adaptive Control™ microprocessor control algorithms.

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 LC-38 ALT. 2A

------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	46,748	147	1,318	2
Feb	42,147	150	982	1
March	48,292	172	250	0
April	49,410	183	0	0
May	83,958	283	0	0
June	107,750	323	0	0
July	116,524	331	0	0
Aug	112,931	317	0	0
Sept	79,262	268	0	0
Oct	52,016	180	4	0
Nov	45,107	162	484	1
Dec	45,980	151	1,060	1
Total	830,127	331	4,098	2

Building Energy Consumption = 59,870 (Btu/Sq Ft/Year)   Floor Area = 54,167 (Sq Ft)
Source Energy Consumption = 164,894 (Btu/Sq Ft/Year)

Σ monthly KW FOR CHILLER PLANT = 1406
P24072 = 111.9
ALT 2A = 1517.9

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
		Monthly Consumption													
0	LIGHTS														
	ELEC	18033	16350	19493	17327	18763	18689	17401	19493	17327	18763	17130	17401		216,171
	PK	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7		86.7
1	MISC LD														
	ELEC	16519	14933	16813	15960	16666	16235	16391	16813	15960	16666	15923	16391		195,273
	PK	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7		33.7
2	MISC LD														
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060		4,098
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4		1.8
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
√ 1	EQ1510.C	RTAA Air Cooled Series R chiller													
	ELEC	3611	3108	3349	7575	38511	62205	71516	65601	36289	7765	3685	3590		306,804
	PK	14.2	22.4	38.9	66.6	145.4	186.2	193.8	180.1	130.8	64.2	29.3	18.5	1231.9	193.8
√ 1	EQ5200	CONDENSER FANS													
	ELEC	185	170	237	419	1618	2492	2816	2625	1557	422	241	197		12,978
	PK	0.6	0.8	1.7	2.9	5.6	5.6	5.6	5.6	5.2	2.8	1.3	0.8	38.5	5.6
√ 1	EQ5001	CHILLED WATER PUMP C.V.													
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325		98,024
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	134.4	11.2
√ 1	EQ5302	CONTROLS													
	ELEC	74	67	74	72	74	72	74	74	72	74	72	74		876
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2	0.1

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 331.1 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1510.C	RTAA Air Cooled Series R chiller	210.7	63.63
Sub Total			210.7	63.63
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			86.7	26.18
Base Utilities			0.0	0.00
Misc Equipment			33.7	10.18
Sub Total			120.4	36.37
Grand Total			331.1	100.00

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF 1

CALCULATED BY C. Butler DATE 3.9.92

CHECKED BY ______ DATE ______

SCALE ______

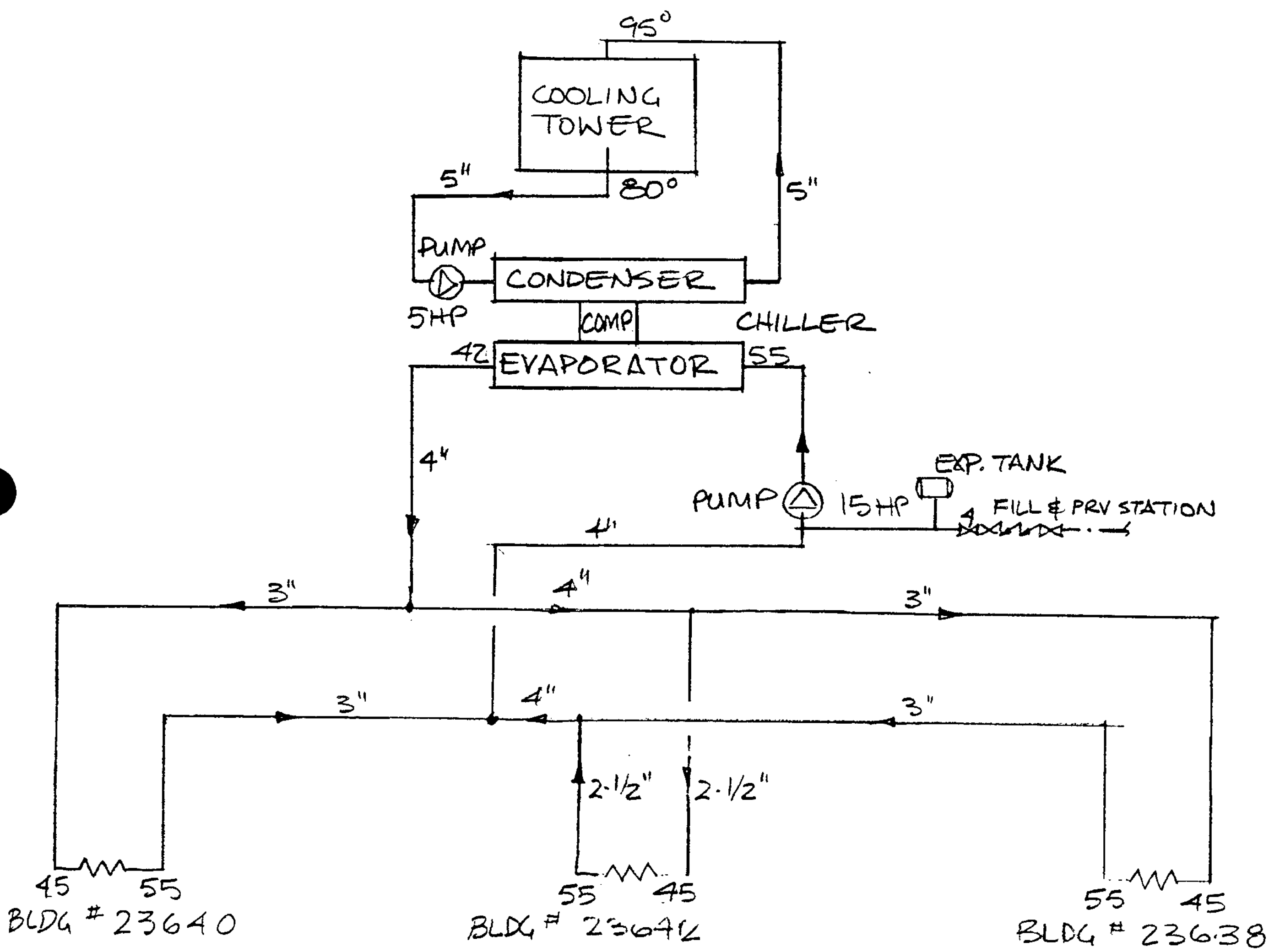
E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX #38

ALT #2B

SCHEMATIC



LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: LAUNCH COMPLEX 38 - CHILLER PLANT STUDY - ALT. 2B   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/05/92   ECONOMIC LIFE: 25   PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST		=	$367,262	
B. SIOH COST	(5.5% of 1A)	=	$20,199	
C. DESIGN COST	(6.0% of 1A)	=	$22,036	
D. ENERGY CREDIT	(1A + 1B + 1C)	=	$409,497	
E. SALVAGE VALUE		=	$0	
F. TOTAL INVESTMENT	(1D – 1E)	=	————>	$409,497

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	4,161	$26,966	15.23	$410,695	
B. DIST		0	$0	17.28	$0	
C. PROPANE	$6.71	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		4,161	26,966.2		————>	$410,695

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS) + (ANNUAL RECURRING MAINTENANCE COST) = $14,253

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $209,234

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$283,750	1	0.96	$272,400
b. EQUIP REPLACEMENT COST	$0	5	0.80	$0
c.	$0		0.00	$0
d TOTAL	$283,750			$272,400

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $481,634

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $135,529

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 1.33

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$52,569
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$892,329
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.18
7 SIMPLE PAYBACK (SPB)	(1F/4) =	7.79

CONSTRUCTION COST ESTIMATE BREAKDOWN

Form Approved
Budget Bureau No. 22-R-100

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): LAUNCH COMPLEX 38 (ALT 2B)	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
	CHILLED WTR GEN, WTR-COOLED 130T (NOM)	EA	1	47100.00	47100	60.00	35.81	2148.6		$49,248.60
	COOLING TOWER, 228T	EA	1	12000.00	12000	48.00	35.81	1719		$13,718.88
	PUMP, CENTRIF. 273 GPM, 15 HP	EA	2	2770.00	5540	32.00	35.81	2292		$7,831.84
	PUMP, CENTRIF. 364 GPM, 5 HP	EA	2	2150.00	4300	24.00	35.81	1719		$6,018.88
	PIPE, INSULATED CONDUIT, 4"	LF	240	23.50	5640	0.72	35.81	6188		$11,827.97
	PIPE, INSULATED CONDUIT, 3"	LF	2260	18.90	42714	0.57	35.81	46130		$88,844.44
	PIPE, INSULATED CONDUIT, 2-1/2"	LF	100	16.30	1630	0.47	35.81	1683		$3,313.07
	TRENCH & BACKFILL, 24"x36"	LUMP SUM	1300 LF	2.81	3653					$3,653.00
	PAVEMENT, REMOVE & REPLACE	LUMP SUM	260 SF	7.00	1820					$1,820.00
	PIPE, BLK STEEL & FTTGS. 5"	LF	100	12.58	1258	0.50	35.81	1791		$3,048.50
	EXPANSION TANK & FILL STA.	LS	1	455.00	455	5.00	35.81	179		$634.05
	CONCRETE PAD FOR TOWER	LUMP SUM	6 CY	100.00	600					$600.00
	MISC. STEEL FOR TOWER	LBS	4000	0.75	3000	0.01	35.81	1003		$4,002.68
	STEEL BUILDING 20'x30'x12'	LUMP SUM	600 SF	30.00	18000					$18,000.00
	-CONTINUED ON NEXT PAGE-									

CONSTRUCTION COST ESTIMATE BREAKDOWN

Form Approved
Budget Bureau No. 22-R-100

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): LAUNCH COMPLEX 38 (ALT 2B)

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
	VALVE, BFLY, CL. 150, 5"	EA	2	115.00	230	4.80	35.81	344		$573.78
	VALVE, BFLY, CL. 150, 4"	EA	4	90.00	360	3.20	35.81	458		$818.37
	INTERCONNECT @ EA BLDG.	EA	3	7000.00	21000	280.00	35.81	30080		$51,080.40
	ETHYLENE GLYCOL	GAL	330	5.90	1947	0.01	35.81	118		$2,065.17
	SUBTOTAL									$267,099.63
	OVERHEAD & PROFIT (25%)									$66,774.91
	CONTINGENCY (10%)									$33,387.45
	TOTAL THIS SHEET									$367,261.99

ESTIMATE SUMMARY

PROJECT: WSMR ESOS STUDY #1110.000
LAUNCH COMPLEX #38

ESTIMATE NO. ALT. #2B
SHEET NO. 1
PREPARED BY: C. Butler DATE: 3-16-92
CHECKED BY: DATE:

MAIN ACCOUNT *	DESCRIPTION	QUANTITY	MATERIALS		LABOR				SUB-CONTRACT		TOTAL
			UNIT PRICE	AMOUNT	UNIT M.H.	TOTAL M.H.	RATE	AMOUNT	UNIT PRICE	AMOUNT	
R. 15-1	CHILLED WTR GEN, WTR-COOLED										
	130T (NOM)	1 EA	47100	47100	60	60	25-	1500			48500
R. 15-2	COOLING TOWER, 228T	1 EA	12000	12000	48	48	25-	1200			13200
R. 15-3	PUMP, CENTRIF. 273GPM, 15HP	2 EA	2770	5540	32	64	25-	1600			7140
R. 15-3	PUMP, CENTRIF. 364 GPM, 5 HP	2. EA	2150	4300	24	48	25-	1200			5500
M.151-851-0730	PIPE, INSULATED CONDUIT, 4"	240 LF	23.50	5640	.72	175	25-	4320			9960
.0720	" " " , 3"	2260 LF	18.90	42710	.57	1288	25	32200			74910
.0710	" " " , 2-1/2"	100 LF	16.30	1630	.47	47	25-	1180			2810
R.2-14, 2-17, 2-21	TRENCH & BACKFILL, 24" x 36"	1300 LF							2.81	3650	3650
M. 020, 025	PAVEMENT, REMOVE & REPLACE	260 SF							7-	1820	1820
M. 151-701-2120	PIPE, BLK STEEL, + FTTGS. 5"	100 LF	12.58	1260	0.5	50	25-	1250			2510
—	EXPANSION TANK & FILL STA.	1 LS	455	455	5.0	5	25	125			580
M.033-130-4701	CONCRETE PAD FOR TOWER	6 CY							100	600	600
M.051-110-0010	MISC. STEEL " "	4000 LBS.	.75	3000	.007	28	25	700			3700
M.970-0010	STEEL BUILDING 20'x30'x12'	600 SF.							30-	18000	18000
M.151-960-1070	VALVE, B'FLY, CL. 150, 5"	2 EA	115	230	4.8	9.6	25-	240			470
" " " .1060	" " " 4"	4 EA	90	360	3.2	12.8	25-	320			680
—	INTERCONNECT @ EA BLDG.	3 EA	7000	21000	280	840	25-	21000			42000
M.157-401-1200	ETHYLENE GLYCOL	330 GAL.	5.90	1950	0.01	3.3	25	80			2030
	TOWER WATER TREATMENT										
											238060

* R = RICHARDSON ESTIMATING GUIDE, M = MEANS ESTIMATING GUIDE.

INPUT FILE NAME : C:\JOBS\EMC\WHITE\RTHA.FRE
PROJECT : WHITE SANDS PROJECT
LOCATION : NEW MEXICO
BUILDING OWNER :
PROGRAM USER : RCH
COMMENT : FOR CHET BUTLER
EPS FLAG : Y

***** INPUT CONDITIONS **

MACHINE TAG	2-B	MOTOR KW SIZE	
COMPRESSOR SIZE	130	VOLTAGE	460
SHELL TYPE	LONG	FREQUENCY	60
DESIGN DUTY		MAX KW/TONS	
DESIGN KW		REFRIGERANT	22
EG			
EXITING EVAP TEMP	42	ENTERING COND TEMP	80
EVAP FLOW RATE		COND FLOW RATE	
ENTERING EVAP TEMP	55	EXITING COND TEMP	95
EVAPORATOR PASSES	3	CONDENSER PASSES	2
EVAP FOULING FACTOR	0.00025	COND FOULING FACTOR	0.00025
MAX EVAP PRESSURE DROP		MAX COND PRESSURE DROP	
BUILT BY	PUEBLO	COND TUBE TYPE	STD
BRINE TYPE	EG	BRINE TYPE	
BRINE %	30	BRINE %	0

***** OUTPUT DATA ***

NOTE - RATING OUTSIDE THE SCOPE OF THE ARI CENTRIFUGAL AND
ROTARY WATER CHILLERS CERTIFICATION PROGRAM.

MODEL RTHA	130	
SHELL LENGTH	LONG	
DESIGN DUTY	121	TONS
POWER CONSUMED	95	KW
KW PER DESIGN DUTY	0.79	
EXIT EVAP TEMP	42.0	F
EVAP FLOW RATE	245	GPM
ENTERING EVAP TEMP	55.0	F
EVAPORATOR PASSES	3	
EVAP PRESSURE DROP	16	FEET
EVAP FOULING FACTOR	0.00025	
EVAP BRINE TYPE	EG	
EVAP BRINE PERCENT	30	
EVAP BRINE FREEZE PT	5.1	F
ENTERING COND TEMP	80.0	F
COND FLOW RATE	237	GPM 145.1
EXIT COND TEMP	95.0	F
CONDENSER PASSES	2	
COND PRESSURE DROP	9	FEET
COND FOULING FACTOR	0.00025	
COND BRINE TYPE	WATER	
COND BRINE PERCENT	0	
COND TUBE TYPE	STANDARD	
NOMINAL MOTOR KW	107	KW
MAX LRA AT NOMINAL MOTOR KW	658	AMPS
RLA AT MOTOR KW	151	AMPS
RLA AT SELECTION KW	133	AMPS
SHIP WEIGHT	5857	LBS
OPERATING WEIGHT	6920	LBS

D18-76

E M C ENGINEERS, INC.
Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX # 38
ALT # 2B

JOB WSMR ESOS STUDY # 1110.000
SHEET NO. ______ OF ______
CALCULATED BY C. Butler DATE 3.9.92
CHECKED BY ______ DATE ______
SCALE ______

ALT. # 2B WATER-COOLED CENTRIFUGAL. SERVING 23640, 23642 & 23638

A. EVAPORATOR:

USING APPLICABLE DATA FROM ALT. # 2A:

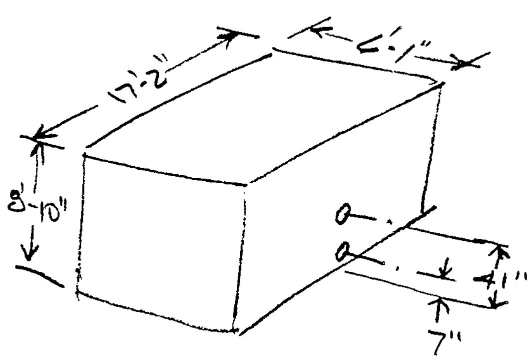
GPM: 273 (30% BY WT, GLYCOL SOLN.)
HEAD: 106' W.C.
MOTOR HP: 15
CAPY: 121.3 TON R. (ADJ. FOR GLYCOL, FOULING FACTOR & ALT.)

B. CONDENSER:

GPM: 121.3 TON × 3.0 GPM/TON = 364 GPM
HEAD:
STATIC HD = 10' (EST, SEE BELOW)
P.D. COND. = 20'
P.D. SPRAY HDS = 0'
30'

PUMP HP = 1.2 × 364 × 30/3960 × 0.7 = 4.7 SAY <u>5 HP</u>.

C. COOLING TOWER SELECTION:
(SEE ATTACHED BAC SELECTION SHEETS).



MOD. 3130 ~$9000 W/FRT.
$12000 W/FRT.
FOR MODEL
JE-130
TOTAL CORR RES.
S.S. FRAME
FIBERGLAS.
ELSEWHERE

WITH 5 HP FAN MOTOR.

E M C ENGINEERS, INC.

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JOB

SHEET NO. OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

D. CHILLER SELECTION

REQD CAPACITY: 120 T. (APPROX. ADJ. FOR .00025 F.F. & 30% GLYCOL.)

LVG WTR TEMP: 42 F

WTR TEMP RISE 13 F

ENT COND WTR TEMP 80 F

COND. WTR FLOW 360 GPM

FOULING FACTOR 0.00025

POWER 460/3/60

USE A TRANE MODEL RTHA 130 - 2 PASS W/STD EVAP & COND SHELL.

SERIES 3000 CAPACITY TABLES

CTI — THERMAL PERFORMANCE CERTIFIED BY THE COOLING TOWER INSTITUTE (CTI) IN ACCORDANCE WITH CTI STANDARD STD-201

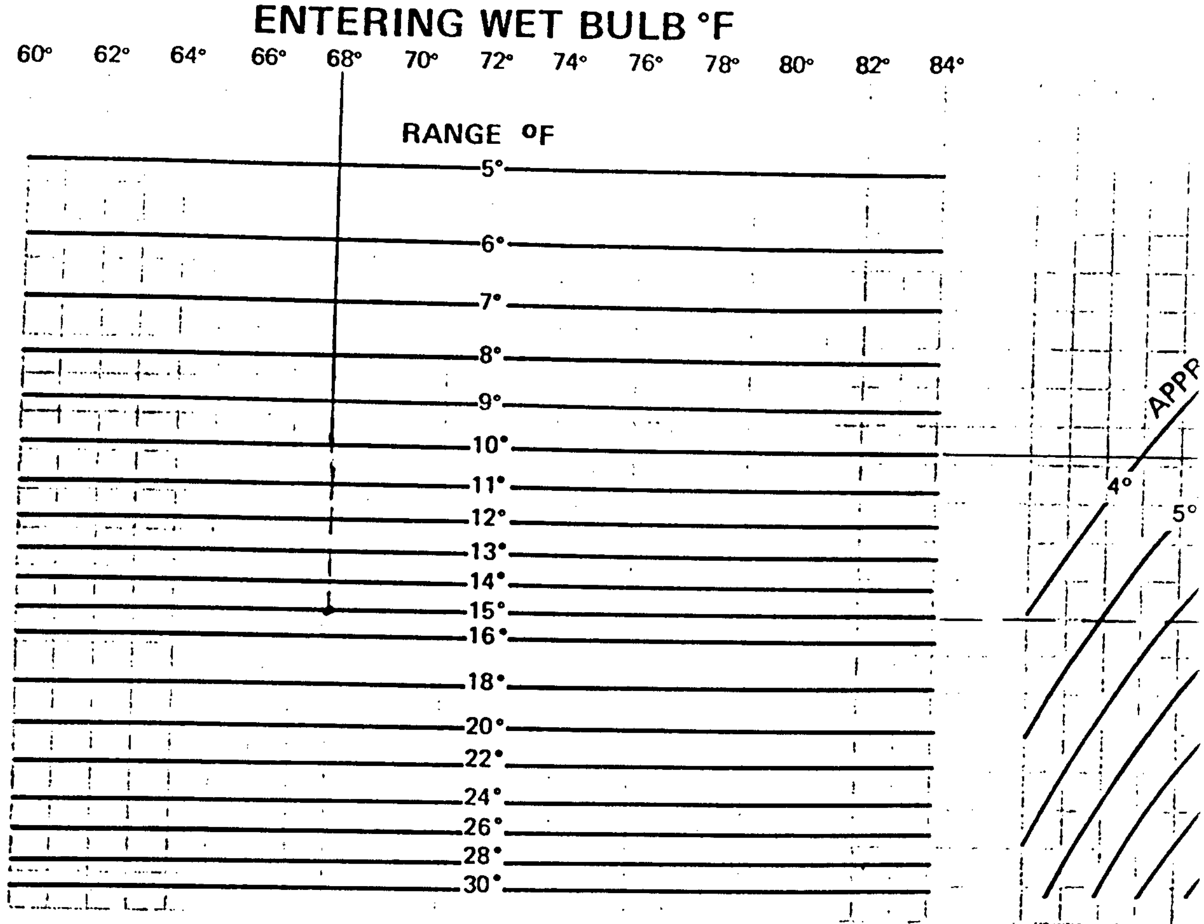
TABLE 1—SINGLE CELL SELECTIONS

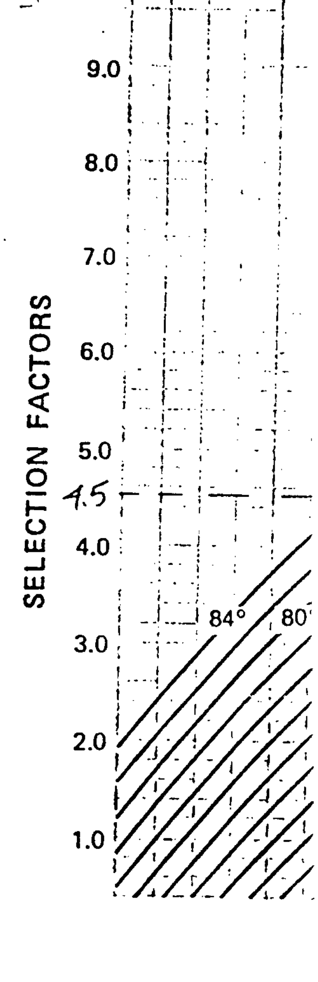
MODEL NUMBER	SELECTION FACTOR																	
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
3130	N.A.	217	234	251	270	291	313	337	362	390	420	451	486	523	562	605	651	701
3150	234	251	270	291	313	336	362	389	418	450	484	521	560	602	648	697	749	806
3165	257	277	298	320	344	370	398	428	460	495	532	572	616	662	712	766	823	885
3184	289	311	334	360	387	416	447	480	516	555	597	641	690	741	797	857	921	990
3185	290	311	335	360	387	416	447	480	516	555	597	641	689	741	796	856	920	989
3205	322	346	372	400	429	461	496	533	572	615	661	710	763	820	881	947	1017	1093
3213	335	360	387	415	446	480	515	554	595	639	687	738	793	851	915	983	1056	1135
3235	371	398	428	459	493	530	569	611	656	705	757	813	874	938	1008	1082	1162	1249
3269	426	457	491	527	566	608	652	700	752	807	866	930	998	1072	1151	1235	1326	1424
3294	467	501	538	577	620	665	714	766	822	882	947	1016	1090	1170	1256	1347	1446	1552
3315	502	538	577	620	665	713	765	821	881	945	1014	1088	1167	1252	1343	1441	1546	1659
3341	546	585	627	673	722	774	830	890	954	1023	1097	1176	1261	1353	1450	1555	1668	1788
3373	599	642	688	738	791	848	909	974	1044	1119	1199	1286	1378	1477	1583	1697	1819	1950
3400	644	690	740	793	849	910	975	1045	1120	1200	1286	1378	1477	1582	1695	1817	1947	2086
3424	684	733	786	842	901	966	1035	1108	1187	1272	1363	1460	1564	1675	1795	1923	2060	2207
3427	684	733	786	843	904	969	1039	1114	1195	1281	1374	1473	1579	1693	1816	1947	2087	2238
3458	736	788	845	906	971	1041	1116	1196	1282	1374	1473	1579	1692	1814	1944	2084	2234	2395
3485	781	837	896	961	1030	1103	1182	1267	1358	1455	1559	1671	1791	1919	2056	2204	2361	2531
3514	832	891	954	1022	1094	1172	1255	1344	1440	1542	1651	1769	1894	2029	2173	2327	2492	2669
3560	910	974	1042	1116	1195	1279	1369	1466	1569	1680	1799	1925	2061	2207	2362	2529	2707	2898
3586	909	984	1063	1147	1236	1330	1429	1533	1643	1758	1879	2005	2136	2274	2416	2564	2718	2876
3642	1001	1082	1169	1260	1357	1460	1568	1681	1801	1926	2057	2194	2337	2486	2640	2800	2966	3137
3685	1072	1158	1251	1348	1451	1560	1675	1795	1922	2055	2194	2339	2490	2648	2811	2981	3156	3337
3707	1063	1157	1256	1361	1472	1590	1713	1843	1979	2121	2269	2423	2583	2748	2918	3094	3273	3457
3758	1145	1245	1351	1463	1582	1708	1839	1978	2123	2274	2432	2595	2765	2940	3121	3307	3497	3691
3803	1218	1324	1436	1554	1680	1812	1951	2097	2250	2409	2575	2747	2925	3109	3299	3494	3693	N.A.
3813	1178	1289	1407	1533	1665	1806	1953	2108	2270	2439	2614	2796	2983	3175	3372	3573	N.A.	N.A.
3860	1251	1368	1493	1626	1766	1914	2069	2232	2403	2580	2764	2954	3151	3352	3558	N.A.	N.A.	N.A.
3935	1369	1496	1632	1775	1927	2087	2255	2431	2614	2805	3003	3207	3418	3634	3855	4080	4308	N.A.
3990	1456	1591	1734	1885	2046	2214	2391	2576	2769	2970	3178	3393	3613	3840	4071	4306	N.A.	N.A.
31055	1560	1703	1855	2016	2186	2365	2553	2749	2953	3165	3385	3611	3844	4082	4326	N.A.	N.A.	N.A.

TABLE 2—DOUBLE CELL SELECTIONS

MODEL NUMBER	SELECTION FACTOR																	
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
3130-2	N.A.	434	468	502	540	582	626	674	724	780	840	902	972	1046	1124	1210	1302	1402
3150-2	468	502	540	582	626	672	724	778	836	900	968	1042	1120	1204	1296	1394	1498	1612
3165-2	514	554	596	640	688	740	796	856	920	990	1064	1144	1232	1324	1424	1532	1646	1770
3184-2	578	622	668	720	774	832	894	960	1032	1110	1194	1282	1380	1482	1594	1714	1842	1980
3185-2	580	622	670	720	774	832	894	960	1032	1110	1194	1282	1378	1482	1592	1712	1840	1978
3205-2	644	692	744	800	858	922	992	1066	1144	1230	1322	1420	1526	1640	1762	1894	2034	2186
3213-2	670	720	774	830	892	960	1030	1108	1190	1278	1374	1476	1586	1702	1830	1966	2112	2270
3235-2	742	796	856	918	986	1060	1138	1222	1312	1410	1514	1626	1748	1876	2016	2164	2324	2498
3269-2	852	914	982	1054	1132	1216	1304	1400	1504	1614	1732	1860	1996	2144	2302	2470	2652	2848
3294-2	934	1002	1076	1154	1240	1330	1428	1532	1644	1764	1894	2032	2180	2340	2512	2694	2892	3104
3315-2	1004	1076	1154	1240	1330	1426	1530	1642	1762	1890	2028	2176	2334	2504	2686	2882	3092	3318
3341-2	1092	1170	1254	1346	1444	1548	1660	1780	1908	2046	2194	2352	2522	2706	2900	3110	3336	3576
3373-2	1198	1284	1376	1476	1582	1696	1818	1948	2088	2238	2398	2572	2756	2954	3166	3394	3638	3900
3400-2	1288	1380	1480	1586	1698	1820	1950	2090	2240	2400	2572	2756	2954	3164	3390	3634	3894	4172
3424-2	1368	1466	1572	1684	1802	1932	2070	2216	2374	2544	2726	2920	3128	3350	3590	3846	4120	4414
3427-2	1368	1466	1572	1686	1808	1938	2078	2228	2390	2562	2748	2946	3158	3386	3632	3894	4174	4476
3458-2	1472	1576	1690	1812	1942	2082	2232	2392	2564	2748	2946	3158	3384	3628	3888	4168	4468	4790
3485-2	1562	1674	1792	1922	2060	2206	2364	2534	2716	2910	3118	3342	3582	3838	4112	4408	4722	5062
3514-2	1664	1782	1908	2044	2188	2344	2510	2688	2880	3084	3302	3538	3788	4058	4346	4654	4984	5338
3560-2	1820	1948	2084	2232	2390	2558	2738	2932	3138	3360	3598	3850	4122	4414	4724	5058	5414	5796
3586-2	1818	1968	2126	2294	2472	2660	2858	3066	3286	3516	3758	4010	4272	4548	4832	5128	5436	5752
3642-2	2002	2164	2338	2520	2714	2920	3136	3362	3602	3852	4114	4388	4674	4972	5280	5600	5932	6274
3685-2	2144	2316	2502	2696	2902	3120	3350	3590	3844	4110	4388	4678	4980	5296	5622	5962	6312	6674
3707-2	2126	2314	2512	2722	2944	3180	3426	3686	3958	4242	4538	4846	5166	5496	5836	6188	6546	6914
3758-2	2290	2490	2702	2926	3164	3416	3678	3956	4246	4548	4864	5190	5530	5880	6242	6614	6994	7382
3803-2	2436	2648	2872	3108	3360	3624	3902	4194	4500	4818	5150	5494	5850	6218	6598	6988	7386	N.A.
3813-2	2356	2578	2814	3066	3330	3612	3906	4216	4540	4878	5228	5592	5966	6350	6744	7146	N.A.	N.A.
3860-2	2502	2736	2986	3252	3532	3828	4138	4464	4806	5160	5528	5908	6302	6704	7116	N.A.	N.A.	N.A.
3935-2	2738	2992	3264	3550	3854	4174	4510	4862	5228	5610	6006	6414	6836	7268	7710	8160	8616	N.A.
3990-2	2912	3182	3468	3770	4092	4428	4782	5152	5538	5940	6356	6786	7226	7680	8142	8612	N.A.	N.A.
31055-2	3120	3406	3710	4032	4372	4730	5106	5498	5906	6330	6770	7222	7688	8164	8652	N.A.	N.A.	N.A.

SERIES 3000 SELECTION CHART





STEP-BY-STEP PROCEDURE FOR SELECTING A SERIES 3000 COOLING TOWER

GPM 360 Water In 95 *°F Water Out 85 (80) °F Wet Bulb 68 °F
*Do not exceed 120°F

(80) (15)

1. Determine Range: Water In 95 °F - Water Out 85 °F = 10 °F = Range

2. Determine Approach: Water Out 85 (80) °F - Water Bulb 68 °F = 17 (12) °F = Approach

3. Determine Selection Factor

Entering at the design Wet Bulb temperature, project a line vertically downward to intersect the Range determined above. From this point project a horizontal line to the right intersecting the Approach curve at that temperature determined above. Then project a line vertically downward to intersect the design Wet Bulb line. Read the Selection Factor at this point.

Selection Factor = 8.5 (4.5)

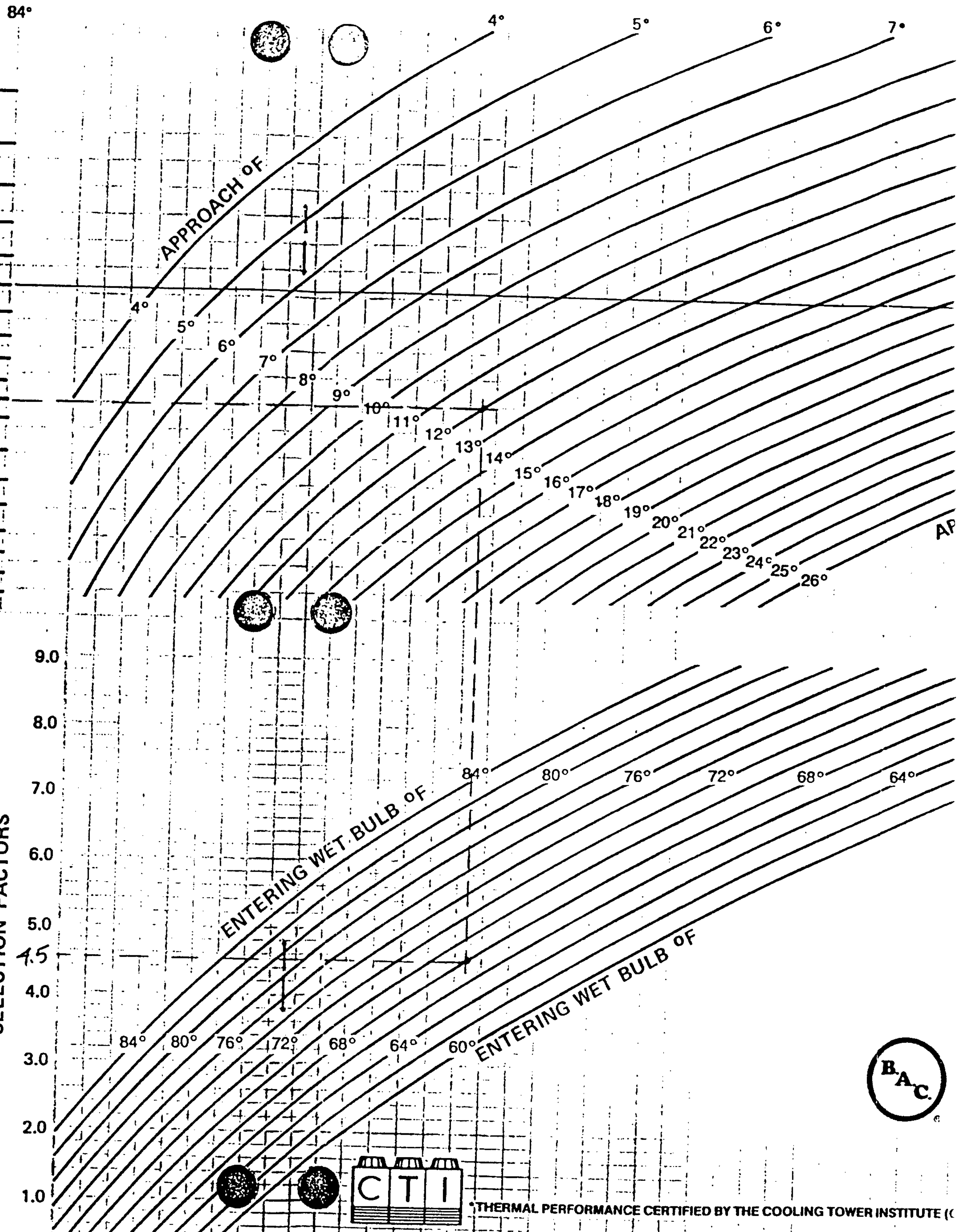
4. Select Unit

Turn to the Series 3000 Capacity Tables on page 10 which tabulate the tower capacities in USGPM for Selection Factors ranging from 0.50 to 9.00. To select a tower, enter the table and read across the Selection Factor line to a factor EQUAL TO OR JUST LESS THAN the factor determined in Step 3. Read down the column until reaching a flow rate EQUAL TO OR GREATER THAN the design flow. Read the tower model number from the column on the left. If desired, the exact flow capacity can be found by interpolating directly between listed selection factors.

If the required flow rate exceeds all values shown in Table 1 (single cell units) for the appropriate Selection Factor, repeat the procedure using Table 2 (Double Cell units). Selection of three or more cells can be obtained by dividing the required flow rate by the number of cells required and utilizing Table 1.

FINAL SELECTION IS MODEL 3130

RT



68 °F

)

_ °F = Range

17 °F =

12)

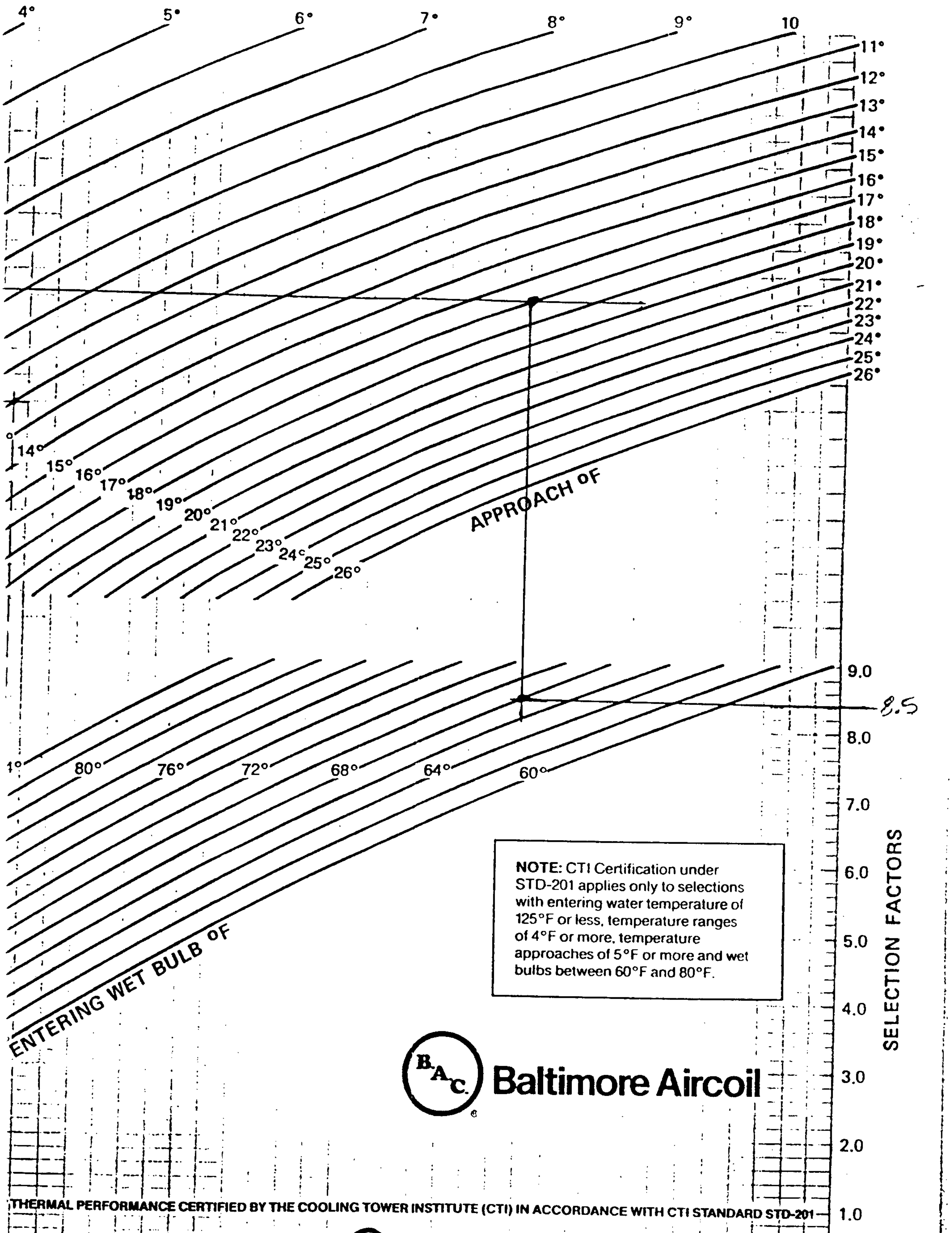
ct the Range
e Approach
intersect the

s in USGPM
d across the
ed in Step 3.
design flow.
acity can be

appropriate
ree or more
and utilizing

2

* Mark owned by the Cooling Tower Institute



Mark owned by the Cooling Tower Institute

3

Selection Procedure

Given:

Required Capacity	200 tons
Leaving Chilled Water Temperature	45 F
Chilled Water Temperature Drop	12 F
Entering Condenser Water Temperature	85 F
Condenser Water Flow	600 GPM
Condenser/Evaporator Fouling Factor	0.00025
Supply Voltage	460/60/3

1

From Table 14-1 on page 14, an RTHA 215 with standard length shells, 3 pass evaporator and 2 pass condenser at the given conditions will produce 200 tons at 148 Kw (.74 Kw/ton × 200 tons).

2

Evaporator GPM and pressure drop can be determined as follows:

$$\text{GPM} = \frac{\text{Tons} \times 24}{\text{Chilled Water } \Delta T} =$$

$$\frac{200 \times 24}{12} = 400 \text{ Gpm}$$

Evaporator pressure drop for 400 GPM from Chart 17-1 on page 17 is 11 feet of water.

3

Condenser pressure drop for 600 GPM from Chart 17-3 on page 17 is 14 feet of water.

Selection Summary:

Model	RTHA 215
Capacity	200 Tons
Power Input	148 Kw
Entering/Leaving Chilled Water Temperature	57/45 F
Evaporator Flow	400 GPM
Evaporator Pressure Drop	11 Feet
Entering Condenser Water Temperature	85 F
Condenser Water Flow	600 GPM
Condenser Pressure Drop	14 Feet
Condenser/Evaporator Fouling Factor	.00025
Supply Voltage	460/60/3
Rated Load Amps	206 Amps

TRANE™

Performance Data

RTHA 130 — RTHA 150

Table 10-1 — Performance Examples (English)

Capacity Tons	Standard Shell	Long Shell
125	RTHA 130 Std .77 Kw/Ton 11' EPD; 15' CPD	RTHA 130 Long .72 Kw/Ton 14' EPD; 19' CPD
150	RTHA 150 Std .74 Kw/Ton 13' EPD; 17' CPD	RTHA 150 Long .69 Kw/Ton 16' EPD; 21' CPD

Notes:
1. Performance is based on three-pass evaporator and two-pass condenser, .00025 Fouling Factor in the evaporator and condenser based on ARI Standard 550-90, 45 F evaporator water (2.0 gpm/ton), 85 F entering condenser water (3.0 gpm/ton).
2. The selections are representative. Chiller selections can be optimized through the use of the Series R® CenTraVac® selection program available through the local Trane Sales Office.
3. EPD = evaporator pressure drop; CPD = condenser pressure drop.

Table 10-2 — Well Water Performance Examples

Capacity Tons	Standard Shell	Long Shell
125	RTHA 130 Std .51 Kw/Ton 11' EPD; 16' CPD	RTHA 130 Long .47 Kw/Ton 14' EPD; 21' CPD
150	RTHA 150 Std .50 Kw/Ton 13' EPD; 18' CPD	RTHA 150 Long .46 Kw/Ton 16' EPD; 22' CPD

Notes:
1. Performance is based on three-pass evaporator and two-pass condenser, .00025 fouling factor in the evaporator and condenser based on ARI Standard 550-90, 44 F evaporator water (2.0 gpm/ton), 65 F entering condenser water (3.0 gpm/ton).
2. The selections are representative. Chiller selections can be optimized through the use of the Series R CenTraVac selection program available through the local Trane Sales Office.
3. EPD = evaporator pressure drop; CPD = condenser pressure drop.

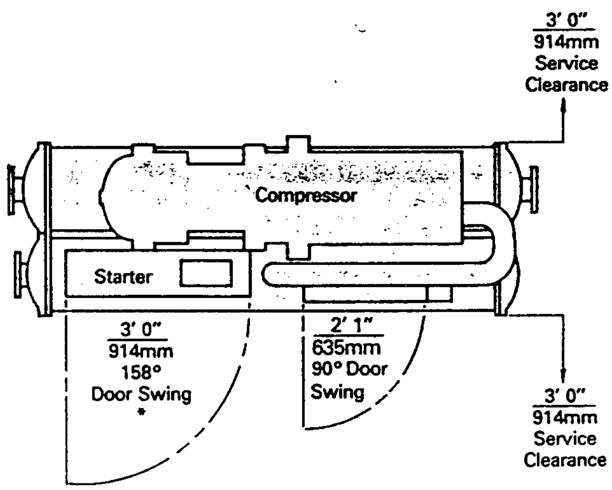
Dimensions RTHA 130 — RTHA 150

English Dimensions				
Unit	Starter	A	B	C
130/150 Ton Std.	460/575V	8' 10⅞"	5' 9½"	7' 0½"
130/150 Ton Std.	200/230V	8' 10⅞"	6' 2½"	7' 0½"
130/150 Ton Long	460/575V	11' 4⅞"	5' 9½"	9' 6½"
130/150 Ton Long	200/230V	11' 4⅞"	6' 2½"	9' 6½"

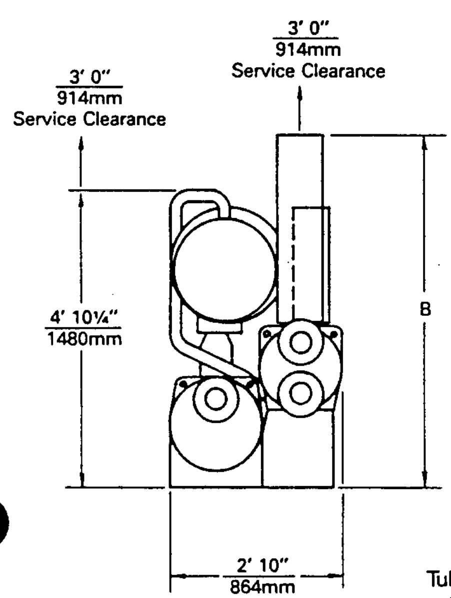
Metric Dimensions				
Unit	Starter	A	B	C
130/150 Ton Std.	460/575V	2715mm	1765mm	2146mm
130/150 Ton Std.	200/230V	2715mm	1892mm	2146mm
130/150 Ton Long	460/575V	3477mm	1765mm	2908mm
130/150 Ton Long	200/230V	3477mm	1892mm	2908mm

*460/575V Starter Shown: 200/230V Starter Has Two Doors (2' – 5⅝" and 1' – 1⅝") (Total Width Is 3' – 8").

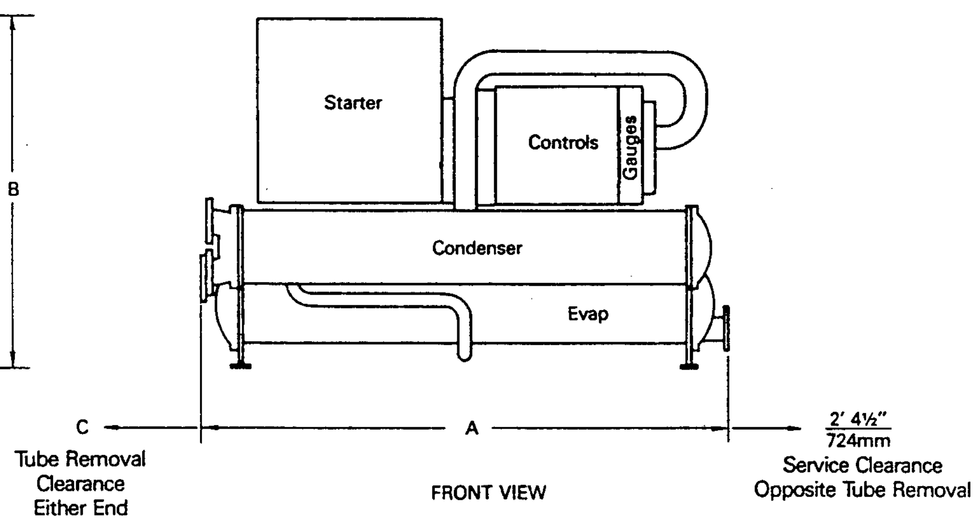
752mm 346mm 1118mm



TOP VIEW



END VIEW



FRONT VIEW

General Data

RTHA 130 — RTHA 150

Table 12-1 — Electrical Data

Model	Nominal Motor Rating (Kw)	Nominal Voltage	200	230	460	575
		Voltage Utilization Range	180/220	207/253	414/506	518/632
RTHA 130	107	RLA	348	302	151	121
		MCA	435	378	189	151
		LRA	1502	1316	658	544
RTHA 150	121	RLA	390	339	170	136
		MCA	488	424	213	170
		LRA	1846	1555	803	630

Notes:

1. RLA = Rated Load Amps.
   MCA = Minimum Circuit Ampacity is 125% of the compressor RLA per NEC 440-32 and 440-33.
   LRA = Locked Rotor Amps.
2. In all cases, the motor to be furnished must have a KW rating equal to or greater than the full load KW determined from the cataloged data or the Series R® CenTraVac® Computer Selection Program.

Table 12-2 — General Data

		RTHA 130		RTHA 150	
		Standard Shell	Long Shell	Standard Shell	Long Shell
Refrigerant Type		R-22	R-22	R-22	R-22
Refrigerant Charge	(lb)	255	285	255	285
	(kg)	116	129	116	129
Oil Charge	(gal)	4.4	4.4	4.4	4.4
	(L)	16.7	16.7	16.7	16.7
Operating Weight	(lb)	5690	6920	5690	6290
	(kg)	2581	2853	2581	2853
Shipping Weight	(lb)	5351	5857	5351	5857
	(kg)	2428	2656	2428	2656

Table 12-3 — Evaporator Data

		RTHA 130								RTHA 150							
		Standard Shell				Long Shell				Standard Shell				Long Shell			
		1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass	1 Pass	2 Pass	3 Pass	4 Pass
Storage Capacity	(gal)	17	17	17	17	22	22	22	22	19	19	19	19	25	25	25	25
	(L)	64	64	64	64	83	83	83	83	72	72	72	72	95	95	95	95
Minimum Flow Rate	(GPM)	376	188	125	94	376	188	125	94	430	215	143	107	430	215	143	107
	(L/s)	24	12	8	6	24	12	8	6	27	14	9	7	27	14	9	7
Maximum Flow Rate	(GPM)	1374	687	458	344	1374	687	458	344	1576	788	525	394	1576	788	525	394
	(L/s)	87	43	29	22	87	43	29	22	99	50	33	25	99	50	33	25
Connection Size	(IN)	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4

Table 12-4 — Condenser Data

		RTHA 130		RTHA 150	
		Standard Shell	Long Shell	Standard Shell	Long Shell
		2 Pass	2 Pass	2 Pass	2 Pass
Storage Capacity	(gal)	13	17	15	20
	(L)	49	64	57	76
Minimum Flow Rate	(GPM)	149	149	173	173
	(L/s)	9	9	11	11
Maximum Flow Rate	(GPM)	545	545	636	636
	(L/s)	34	34	40	40
Connection Size	(IN)	4	4	4	4

Water Pressure Drop Data

RTHA 130 — RTHA 150

Chart 13-1 — Standard Length Evaporators

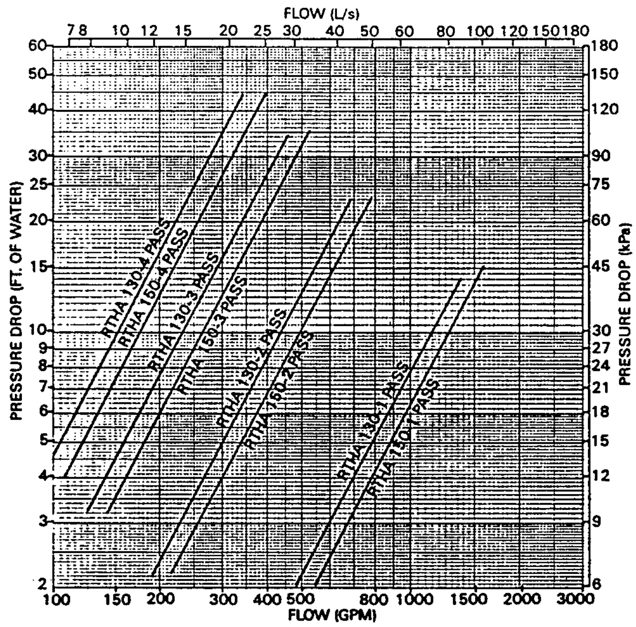


Chart 13-2 — Long Length Evaporators

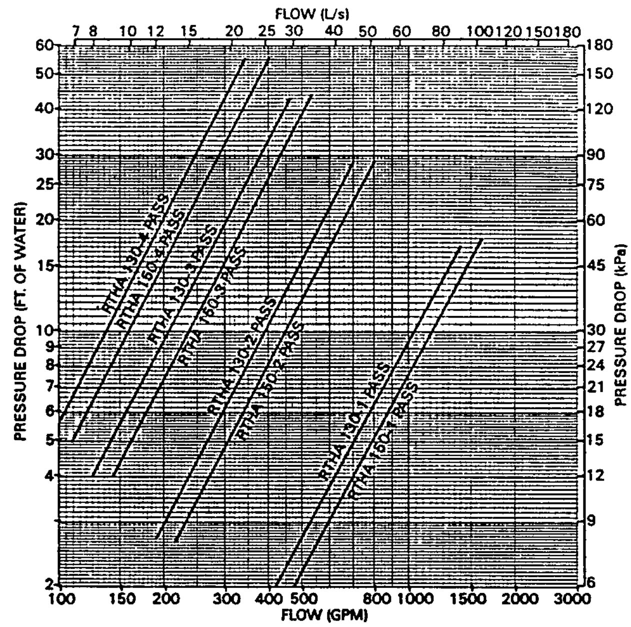


Chart 13-3 — Standard Length Condensers

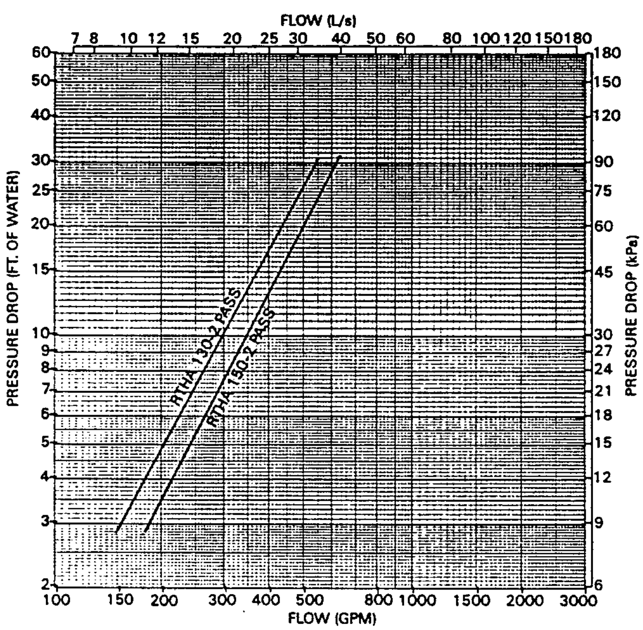
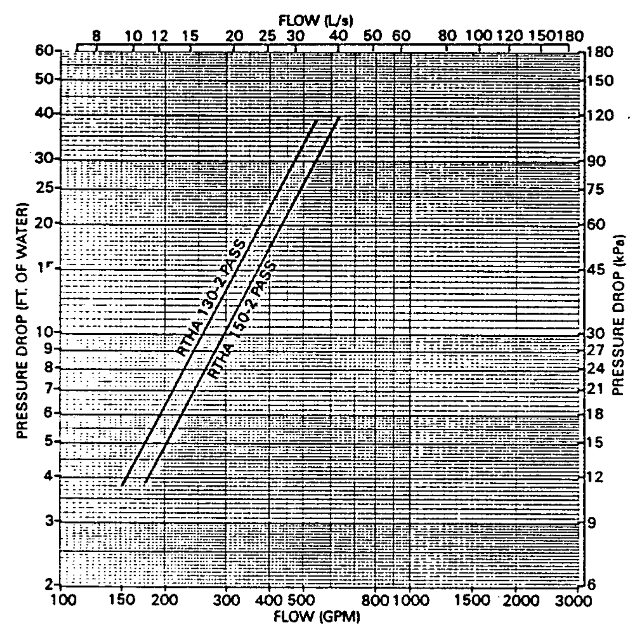


Chart 13-4 — Long Length Condensers



MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 LC-38 ALT 2B

------------------------------ MONTHLY ENERGY CONSUMPTION ------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	55,705	152	1,318	30	2
Feb	50,270	153	982	27	1
March	57,098	158	250	28	0
April	56,808	170	0	37	0
May	70,276	193	0	111	0
June	77,630	212	0	163	0
July	82,872	219	0	189	0
Aug	83,622	212	0	176	0
Sept	70,733	192	0	108	0
Oct	61,932	169	4	38	0
Nov	53,358	155	484	28	1
Dec	54,891	153	1,060	30	1
Total	775,196	219	4,098	965	2

Building Energy Consumption = 56,409 (Btu/Sq Ft/Year) Floor Area = 54,167 (Sq Ft)
Source Energy Consumption = 154,509 (Btu/Sq Ft/Year)

Σ monthly kW FOR CHILLER PLANT = 699.2

P 24072 111.9

ALT 2B 811.1

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec		Total
		Monthly Consumption													
0	LIGHTS														
	ELEC	18033	16350	19493	17327	18763	18689	17401	19493	17327	18763	17130	17401		216,171
	PK	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7		86.7
1	MISC LD														
	ELEC	16519	14933	16813	15960	16666	16235	16391	16813	15960	16666	15923	16391		195,273
	PK	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7		33.7
2	MISC LD														
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060		4,098
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4		1.8
3	MISC LD														
	OIL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
4	MISC LD														
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
5	MISC LD														
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
6	MISC LD														
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0		0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
1	EQ1500	TRANE SERIES R CTV >200 TONS													
	ELEC	9308	8289	8948	9862	17460	23713	29453	27690	18453	10118	8843	9254		181,391
	PK	15.6	17.2	20.7	28.1	46.4	64.8	72.2	64.9	45.7	27.5	18.3	16.5	437.9	72.2
1	EQ5100	COOLING TOWER													
	ELEC	0	0	0	2196	5542	7530	7782	7782	7530	4539	0	0		42,902
	PK	0.0	0.0	0.6	10.5	10.5	10.5	10.5	10.5	10.5	10.5	0.0	0.0	74.1	10.5
1	EQ5100	COOLING TOWER													
	WATER	30	27	28	37	111	163	189	176	108	38	28	30		965
	PK	0.1	0.1	0.1	0.2	0.4	0.4	0.5	0.4	0.3	0.2	0.1	0.1		0.5
1	EQ5001	CHILLED WATER PUMP C.V.													
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325		98,024
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	134.4	11.2
1	EQ5010	CONDENSER WATER PUMP C.V.													
	ELEC	2775	2507	2775	2686	2775	2686	2775	2775	2686	2775	2686	2775		32,675
	PK	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	40.8	3.7

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

Chiller Controls

ELEC	744	672	744	720	744	720	744	744	720	744	720	744		8,760
PK	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12	1.0

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 219.0 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1500	TRANE SERIES R CTV >200 TONS	98.6	45.03
Sub Total			98.6	45.03
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Miscellaneous				
Lights			86.7	39.58
Base Utilities			0.0	0.00
Misc Equipment			33.7	15.39
Sub Total			120.4	54.97
Grand Total			219.0	100.00

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range — REGION: 4 — PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: BLDG. 23640 - ECO'S — FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 06/11/92 — ECONOMIC LIFE: 15 — PREPARED BY: A. STOVER

1 INVESTMENT

A. CONSTRUCTION COST	=	$15,025		
B. SIOH COST	(5.5% of 1A) =	$826		
C. DESIGN COST	(6.0% of 1A) =	$902		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$16,753		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	——————>		$16,753

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	876	$5,670	10.79	$61,178	
B. DIST		0	$0	11.57	$0	
C. PROPANE	$6.71	189	$1,268	12.38	$15,700	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		1,065	6,938.1		——————>	$76,878

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = $8,756
1 DISCOUNT FACTOR (From Table A-2) = 10.67
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = $93,421

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = $93,421

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $25,370

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 6.10

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$15,694
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$170,300
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	10.17
7 SIMPLE PAYBACK (SPB)	(1F/4) =	1.07

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.	ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227
CONTRACT FOR (Work to be performed): ECO'S – BLDG. 23640	PROPOSED TOTAL CONTRACT PRICE:
PURCHASE REQUEST NUMBER:	PROJECT NUMBER:
WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO	

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	374	2.19	819.06	0.09	27.60	908.37		$1,727.43
	ENERGY EFFICIENT BALLASTS	EA	189	14.06	2657.34	0.85	27.60	4439.16		$7,096.50
2	INSTALL DRY-BULB ECONOMIZER ON AHU									
	MIXED, RETURN, & OUTSIDE AIR SENSORS	EA	3	147.50	442.50	0.67	35.81	71.66		$514.16
	RECEIVER CONTROLLER W/ FIELD TEST	EA	1	235.00	235.00	10.00	35.81	358.10		$593.10
	LOW-LEAKAGE DAMPER	EA	2	217.00	434.00	6.00	27.63	331.56		$765.56
	PNEUMATIC ACCUATOR	EA	2	226.00	452.00	1.00	27.63	55.26		$507.26
	PNEUMATIC TUBING	LF	150	0.70	105.00	0.09	27.63	377.15		$482.15
3	CHILLED WATER RESET ON WTR-CLD CHILLER	EA	1	325.00	325.00	12.00	27.60	331.20		$656.20
4	REPLACE 40 HP FAN MTR W/ HI EFF-7.5 HP MTR	EA	1	716.00	716.00	7.24	27.60	199.82		$915.82
5	RESHEAVE FAN - AHU #1	EA	1	345.00	345.00	Includes material & labor				$345.00
6	INSTALL CHILLED WATER COIL - AHU #2	EA	1	1146.0	1146.00	10.00	27.60	276.00		$1,422.00
	TOTAL THIS SHEET									$15,025.18

Source: Lightbulb Supply Co., Denver, CO; Baldor Motors and Drives Cat. – Nov. 1991; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	BLDG. 23642 - ECO'S			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	06/29/92	ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=	$24,053		
B. SIOH COST	(5.5% of 1A) =	$1,323		
C. DESIGN COST	(6.0% of 1A) =	$1,443		
D. ENERGY CREDIT	(1A + 1B + 1C) =	$26,819		
E. SALVAGE VALUE	=	$0		
F. TOTAL INVESTMENT	(1D - 1E) =	————>	$26,819	

2 ENERGY SAVINGS (+) / COST (-)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	184	$1,193	10.79	$12,877	
B. DIST		0	$0	11.57	$0	
C. PROPANE	$6.71	(13)	($90)	12.38	($1,113)	
D. PAPER		0	$0		$0	
E. COAL			$0	11.35	$0	
F. TOTAL		171	1,103.5		————>	$11,763

3 NON-ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS)	=		$5,187	
1 DISCOUNT FACTOR	(From Table A-2) =	10.67		
2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =		$55,345	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a.	$0		0.00	$0
b.	$0		0.00	$0
c.	$0		0.00	$0
d TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-)	(3A2 + 3Bd4) =		$55,345
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$3,882	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.58	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A + (3B1d/25)) =	$6,290
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$67,109
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	2.50
7 SIMPLE PAYBACK (SPB)	(1F/4) =	4.26

CONSTRUCTION COST ESTIMATE BREAKDOWN

Form Approved
Budget Bureau No. 22-R-100

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): ECO'S – BLDG. 23642

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	520	2.19	1138.8	0.09	27.60	1262.98		$2,401.78
	ENERGY EFFICIENT BALLASTS	EA	260	14.06	3655.60	0.85	27.60	6106.78		$9,762.38
2	INSTALL DRY-BULB ECONOMIZERS ON AHUs									
	MIXED, RETURN, & OUTSIDE AIR SENSORS	EA	9	147.50	1327.50	0.67	35.81	214.97		$1,542.47
	RECEIVER CONTROLLER W/ FIELD TEST	EA	3	235.00	705.00	10.00	35.81	1074.30		$1,779.30
	LOW-LEAKAGE DAMPERS (AHUs 2 & 3)	EA	4	217.00	868.00	6.00	27.63	663.12		$1,531.12
	PNEUMATIC ACCUATORS (AHUs 2 & 3)	EA	2	226.00	452.00	1.00	27.63	55.26		$507.26
	OUTSIDE AIR LOUVER	SF	15	32.88	493.20	0.29	27.63	118.53		$611.73
	PNEUMATIC TUBING	LF	120	0.70	84.00	0.09	27.63	301.72		$385.72
	REFURBISH DAMPERS & ACTUATORS (AHU-1)	EA	2	75.00	150.00	4.00	35.81	286.48		$436.48
3	CHILLED WATER RESET ON WTR-CLD CHILLER	EA	2	325.00	650.00	12.00	27.60	662.40		$1,312.40
4	REPLACE MOTORS WITH HI EFF MOTORS	EA	3	716.00	2148.00	7.24	27.60	599.47		$2,747.47
5	RESHEAVE FANS	EA	3	345.00	1035.00	Includes material & labor				$1,035.00
	TOTAL THIS SHEET									$24,053.10

Source: Lightbulb Supply Co., Denver, CO; Baldor Motors and Drives Cat. – Nov. 1992; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision

JOB
CALCULATED BY: DATE:
CHECKED BY: DATE:
PAGE: OF

LIGHTING
ENERGY SAVINGS CALCULATIONS

BLDG.	# HRS/YR	EXISTING					PROPOSED					DEMAND REDUCTION (KW)	ENERGY SAVINGS (KWH)	ANNUAL ELECTRICAL COST SAVINGS	CONSTRUCTION COST ESTIMATE
		# FIXTURES	TYPE	FIXTURE (KW)	TOTAL (KW)	KWH/YR	# FIXTURES	TYPE	FIXTURE (KW)	TOTAL (KW)	KWH/YR				
23640	2210	185	FL	0.096	17.760	39249.6	185	FL	0.071	13.135	29028.3	4.625	10221.3	$1,308.14	
	2210	4	FL	0.056	0.224	495.0	4	FL	0.047	0.188	415.5	0.036	79.6	$10.18	
						39744.6					29443.83	4.661	10300.8	$1,318.32	$11,023.00
23642	2210	192	FL	0.096	18.432	40734.7	192	FL	0.071	13.632	30126.7	4.800	10608.0	$1,357.64	
	2210	34	FL	0.181	6.154	13600.3	34	FL	0.140	4.760	10519.6	1.394	3080.7	$394.28	
						54335.1					40646.32	6.194	13688.7	$1,751.92	$15,194.83

KEY:
- FL = FLUORESCENT
- IN = INCANDESCENT
- MV = MERCURY VAPOR
- MH = METAL HALIDE

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**                                                                         **
**                  T R A C E   6 0 0   A N A L Y S I S                    **
**                                                                         **
**                  by              **
**                                                                         **
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ESOS STUDY AT WSMR - BUILDING 23640
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT PER SOW: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 22: 3:19 3/ 2/92
Dataset Name: 23640B1 .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 7/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	154,401	0		154,401	39.79	155,165	46.20	-76,385	-76,385	56.43
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	42,904	0		42,904	11.06	42,265	12.58	-57,499	-57,499	42.48
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-7,337	-7,337	5.42
Infiltration	27,923			27,923	7.19	22,257	6.63	-19,982	-19,982	14.76
Sub Total==>	225,228	0		225,228	58.04	219,687	65.41	-161,203	-161,203	119.09
Internal Loads										
Lights	42,159	0		42,159	10.86	42,159	12.55	0	0	0.00
People	6,300			6,300	1.62	3,450	1.03	0	0	0.00
Misc	88,118	0	0	88,118	22.71	70,118	20.88	0	0	0.00
Sub Total==>	136,577	0	0	136,577	35.19	115,727	34.46	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				25,842	6.66		0.00		25,842	-1[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	440			440	0.11	440	0.13	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	362,245	0	0	388,087	100.00	335,855	100.00	-161,203	-135,361	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	32.3	388.1	361.6	15,800	72.0	53.1	40.0	48.1	42.2	36.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	32.3	388.1								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	6,677		
Part	800		
ExFlr	222		
Roof	6,677	0	0
Wall	3,650	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-0.0	15,800	76.9	76.9
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	15,800	68.0	48.1
Reheat	0.0	0	0.0	0.0
Humidif	-0.0	474	4.7	4.7
Opt Vent	0.0	0	0.0	0.0
Total	-0.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	0	0
Infil	919	474
Supply	15,800	15,800
Mincfm	0	0
Return	15,800	15,800
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	0.0
Clg Cfm/Sqft	2.37
Clg Cfm/Ton	488.55
Clg Sqft/Ton	206.46
Clg Btuh/Sqft	58.12
No. People	15
Htg % OA	0.0
Htg Cfm/SqFt	2.37
Htg Btuh/SqFt	-0.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	49.8	78.7
Plenum	72.0	68.0
Return	72.0	68.0
Ret/OA	72.0	68.0
Runarnd	72.0	68.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	1.0	0.0

System 2 Block RAD - RADIATION

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 0/ 0					Mo/Hr: 0/ 0		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					OADB: 0		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	-72,072	-72,072	46.12
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	0	0		0	0.00	0	0.00	-57,499	-57,499	36.80
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-7,337	-7,337	4.70
Infiltration	0			0	0.00	0	0.00	-19,354	-19,354	12.39
Sub Total==>	0	0		0	0.00	0	0.00	-156,261	-156,261	100.00
Internal Loads										
Lights	0	0		0	0.00	0	0.00	0	0	0.00
People	0			0	0.00	0	0.00	0	0	0.00
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	0	0.00	0	0.00	0	0	0.00
Sup. Fan Heat				0	0.00		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	0	0	0	0	0.00	0	0.00	-156,261	-156,261	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	0.0	0.0								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	6,300		
Part	0		
ExFlr	222		
Roof	6,300	0	0
Wall	3,650	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-178.2	0	0.0	0.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-178.2			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	0	0
Infil	0	459
Supply	0	0
Mincfm	0	0
Return	0	0
Exhaust	0	0
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	0.0
Clg Cfm/Sqft	0.00
Clg Cfm/Ton	0.00
Clg Sqft/Ton	0.00
Clg Btuh/Sqft	0.00
No. People	0
Htg % OA	0.0
Htg Cfm/SqFt	0.00
Htg Btuh/SqFt	-28.29

TEMPERATURES (F)

Type	Clg	Htg
SADB	0.0	68.1
Plenum	0.0	68.0
Return	0.0	68.0
Ret/OA	0.0	68.0
Runarnd	0.0	68.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 23640

---------------------------------- B U I L D I N G U - V A L U E S ----------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
2	RM 2 - INTERIOR	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
3	ROOM 3	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.6	9.57
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
3	ROOM 3	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.4	9.55
Building		0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.5	9.56

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 23640

-- B U I L D I N G A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	2,100	2,100	0	154	0	0	2,100	0	0	2,460
Zone	1 Total/Ave.				2,100	0	154	0	0	2,100	0	0	2,460
2	RM 2 - INTERIOR	1	1	377	377	800	0	0	0	377	0	0	0
Zone	2 Total/Ave.				377	800	0	0	0	377	0	0	0
3	ROOM 3	1	1	4,200	4,200	0	68	0	0	4,200	0	0	1,190
Zone	3 Total/Ave.				4,200	0	68	0	0	4,200	0	0	1,190
System	1 Total/Ave.				6,677	800	222	0	0	6,677	0	0	3,650
1	ROOM 1	1	1	2,100	2,100	0	154	0	0	2,100	0	0	2,460
Zone	1 Total/Ave.				2,100	0	154	0	0	2,100	0	0	2,460
3	ROOM 3	1	1	4,200	4,200	0	68	0	0	4,200	0	0	1,190
Zone	3 Total/Ave.				4,200	0	68	0	0	4,200	0	0	1,190
System	2 Total/Ave.				6,300	0	222	0	0	6,300	0	0	3,650
Building					12,977	800	445	0	0	12,977	0	0	7,300

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	Cooling Load Cap. (Ton)	Cooling Load Hours (%)	Cooling Load Hours	Heating Load Capacity (Btuh)	Heating Load Hours (%)	Heating Load Hours	Cooling Airflow Cap. (Cfm)	Cooling Airflow Hours (%)	Cooling Airflow Hours	ton-hr	Heating Airflow Cap. (Cfm)	Heating Airflow Hours (%)	Heating Airflow Hours
0 - 5	1.6	0	0	-8,912	0	0	790.0	0	0	0	0.0	0	0
5 - 10	3.2	0	0	-17,824	0	0	1,580.0	0	0	0	0.0	0	0
10 - 15	4.9	0	0	-26,736	0	0	2,370.0	0	0	0	0.0	0	0
15 - 20	6.5	29	2,570	-35,648	0	0	3,160.0	0	0	16705	0.0	0	0
20 - 25	8.1	9	772	-44,561	0	0	3,950.0	0	0	6253	0.0	0	0
25 - 30	9.7	10	876	-53,473	0	0	4,740.0	0	0	8497	0.0	0	0
30 - 35	11.3	8	700	-62,385	0	0	5,530.0	0	0	7960	0.0	0	0
35 - 40	12.9	9	816	-71,297	0	0	6,320.0	0	0	10526	0.0	0	0
40 - 45	14.6	8	702	-80,209	0	0	7,110.0	0	0	10249	0.0	0	0
45 - 50	16.2	5	455	-89,121	0	0	7,900.0	0	0	7371	0.0	0	0
50 - 55	17.8	5	425	-98,033	0	0	8,690.0	0	0	7565	0.0	0	0
55 - 60	19.4	5	395	-106,945	0	0	9,480.0	0	0	7663	0.0	0	0
60 - 65	21.0	3	245	-115,857	0	0	10,270.0	0	0	5145	0.0	0	0
65 - 70	22.6	3	261	-124,769	0	0	11,060.0	0	0	5899	0.0	0	0
70 - 75	24.3	3	232	-133,682	0	0	11,850.0	0	0	5638	0.0	0	0
75 - 80	25.9	2	140	-142,594	0	0	12,640.0	0	0	3626	0.0	0	0
80 - 85	27.5	1	108	-151,506	0	0	13,430.0	0	0	2970	0.0	0	0
85 - 90	29.1	1	63	-160,418	0	0	14,220.0	0	0	1833	0.0	0	0
90 - 95	30.7	0	0	-169,330	0	0	15,010.0	0	0		0.0	0	0
95 - 100	32.3	0	0	-178,242	0	0	15,800.0	100	8,760		0.0	0	0
Hours Off	0.0	0	0	0	0	8,760	0.0	0	0		0.0	0	8,760
										109,280			

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	55,976	107	1,318	28	2
Feb	50,346	107	982	24	1
March	55,358	110	250	23	0
April	54,671	113	0	27	0
May	59,801	116	0	39	0
June	60,645	118	0	46	0
July	63,781	120	0	53	0
Aug	63,876	119	0	51	0
Sept	58,739	115	0	39	0
Oct	56,848	111	4	26	0
Nov	53,568	107	484	24	1
Dec	55,643	107	1,060	27	1
Total	689,253	120	4,098	407	2

Building Energy Consumption = 413,692 (Btu/Sq Ft/Year)   Floor Area = 6,677 (Sq Ft)
Source Energy Consumption = 415,590 (Btu/Sq Ft/Year)

Σ Monthly KW = 1,350

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 120.0 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	41.9	34.92
Sub Total			41.9	34.92
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	29.8	24.86
Sub Total			29.8	24.86
Sub Total			0.0	0.00
Miscellaneous				
Lights			24.0	20.00
Base Utilities			0.0	0.00
Misc Equipment			24.3	20.21
Sub Total			48.3	40.22
Grand Total			120.0	100.00

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**              T R A C E   6 0 0   A N A L Y S I S                         **
**                                                                          **
**              by              **
**                                                                          **
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ESOS STUDY AT WSMR - BUILDING 23640
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT PER SOW: ALT 1-BSLN, ALT2-ECO (MODIFIED CONFIGURATION)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:39:49 3/ 8/92
Dataset Name: 23640 .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

V 600
PAGE 3

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

	Cooling Coil Peak	Clg Space Peak	Heating Coil Peak
Peaked at Time ==>	Mo/Hr: 7/16	Mo/Hr: 7/16	Mo/Hr: 13/ 1
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0	OADB: 97	OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	149,124	0		149,124	42.31	149,957	49.87	-76,385	-76,385	47.66
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	38,984	0		38,984	11.06	38,345	12.75	-57,499	-57,499	35.87
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-7,337	-7,337	4.58
Infiltration	10,713			10,713	3.04	10,127	3.37	-19,982	-19,982	12.47
Sub Total==>	198,821	0		198,821	56.42	198,429	65.99	-161,203	-161,203	100.58
Internal Loads										
Lights	26,252	0		26,252	7.45	26,252	8.73	0	0	0.00
People	6,300			6,300	1.79	3,450	1.15	0	0	0.00
Misc	90,040	0	0	90,040	25.55	72,040	23.96	0	0	0.00
Sub Total==>	122,592	0	0	122,592	34.79	101,742	33.84	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	10,364	2.94	0	0.00	0	-19,211	11.99
Sup. Fan Heat				20,134	5.71		0.00		20,134	-1[illegible]
Ret. Fan Heat		0		0	0.00		0.00		0	0.[illegible]
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	512			512	0.15	512	0.17	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	321,925	0	0	352,423	100.00	300,683	100.00	-161,203	-160,280	100.00

----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering Deg F	Entering Deg F	Entering Grains	Leaving Deg F	Leaving Deg F	Leaving Grains
					DB	WB	HR	DB	WB	HR
Main Clg	29.4	352.4	330.4	12,870	75.8	56.1	46.9	49.0	44.6	43.8
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	29.4	352.4								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	6,677		
Part	800		
ExFlr	222		
Roof	6,677	0	0
Wall	3,650	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-160.3	12,870	66.4	79.4
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	12,870	66.4	49.0
Reheat	0.0	0	0.0	0.0
Humidif	-11.6	930	4.7	25.3
Opt Vent	0.0	0	0.0	0.0
Total	-171.8			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	456	456
Infil	474	474
Supply	12,870	12,870
Mincfm	0	0
Return	12,870	12,870
Exhaust	456	456
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	3.5
Clg Cfm/Sqft	1.93
Clg Cfm/Ton	438.22
Clg Sqft/Ton	227.35
Clg Btuh/Sqft	52.78
No. People	15
Htg % OA	3.5
Htg Cfm/SqFt	1.93
Htg Btuh/SqFt	-24.00

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	50.6	81.1
Plenum	75.0	68.0
Return	75.0	68.0
Ret/OA	75.8	66.4
Runarnd	75.0	68.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.9	0.0

BUILDING U-VALUES - ALTERNATIVE 2
ECO - BUILDING 23640

B U I L D I N G U - V A L U E S

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
2	RM 2 - INTERIOR	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
3	ROOM 3	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.6	9.57
Building		0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.6	9.57

BUILDING AREAS - ALTERNATIVE 2
ECO - BUILDING 23640

B U I L D I N G A R E A S

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	2,100	2,100	0	154	0	0	2,100	0	0	2,460
Zone	1 Total/Ave.				2,100	0	154	0	0	2,100	0	0	2,460
2	RM 2 - INTERIOR	1	1	377	377	800	0	0	0	377	0	0	0
Zone	2 Total/Ave.				377	800	0	0	0	377	0	0	0
3	ROOM 3	1	1	4,200	4,200	0	68	0	0	4,200	0	0	1,190
Zone	3 Total/Ave.				4,200	0	68	0	0	4,200	0	0	1,190
System	1 Total/Ave.				6,677	800	222	0	0	6,677	0	0	3,650
Building					6,677	800	222	0	0	6,677	0	0	3,650

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ---- Cap. (Ton)	Hours (%)	Hours	------ Heating Load ------ Capacity (Btuh)	Hours (%)	Hours	---- Cooling Airflow ----- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow ----- Cap. (Cfm)	Hours (%)	Hours
0 - 5	1.5	19	1,271	-8,592	63	5,500	643.5	0	0	0.0	0	0
5 - 10	2.9	11	762	-17,184	12	1,030	1,287.0	0	0	0.0	0	0
10 - 15	4.4	3	214	-25,776	5	444	1,930.5	0	0	0.0	0	0
15 - 20	5.9	9	588	-34,369	3	259	2,574.0	0	0	0.0	0	0
20 - 25	7.3	9	573	-42,961	2	172	3,217.5	0	0	0.0	0	0
25 - 30	8.8	7	455	-51,553	1	124	3,861.0	0	0	0.0	0	0
30 - 35	10.3	5	342	-60,145	2	139	4,504.5	0	0	0.0	0	0
35 - 40	11.7	4	281	-68,737	1	68	5,148.0	0	0	0.0	0	0
40 - 45	13.2	5	329	-77,329	2	184	5,791.5	0	0	0.0	0	0
45 - 50	14.7	3	232	-85,921	2	157	6,435.0	0	0	0.0	0	0
50 - 55	16.2	4	262	-94,514	2	146	7,078.5	0	0	0.0	0	0
55 - 60	17.6	3	197	-103,106	3	232	7,722.0	0	0	0.0	0	0
60 - 65	19.1	4	261	-111,698	1	90	8,365.5	0	0	0.0	0	0
65 - 70	20.6	4	268	-120,290	1	96	9,009.0	0	0	0.0	0	0
70 - 75	22.0	3	208	-128,882	1	119	9,652.5	0	0	0.0	0	0
75 - 80	23.5	3	190	-137,474	0	0	10,296.0	0	0	0.0	0	0
80 - 85	25.0	1	90	-146,066	0	0	10,939.5	0	0	0.0	0	0
85 - 90	26.4	2	106	-154,659	0	0	11,583.0	0	0	0.0	0	0
90 - 95	27.9	0	20	-163,251	0	0	12,226.5	0	0	0.0	0	0
95 - 100	29.4	0	0	-171,843	0	0	12,870.0	100	8,760	0.0	0	0
Hours Off	0.0	0	2,111	0	0	0	0.0	0	0	0.0	0	8,760

TOT. TON·HRS = 61,121

$$\text{AVG. TONS} = \frac{61,121}{(8760-2111)} = 9.2 \text{ TONS.}$$

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	26,618	71	654	0	2
Feb	24,446	71	483	1	2
March	30,958	71	123	5	1
April	35,447	75	47	15	0
May	42,288	78	54	31	0
June	43,954	80	59	41	0
July	46,880	82	36	48	0
Aug	46,573	81	32	45	0
Sept	42,309	77	15	33	0
Oct	36,656	73	12	14	0
Nov	29,591	71	204	4	1
Dec	26,967	71	490	1	1
Total	432,687	82	2,208	239	2

Building Energy Consumption = 254,245 (Btu/Sq Ft/Year)   Floor Area = 6,677 (Sq Ft)
Source Energy Consumption = 255,268 (Btu/Sq Ft/Year)

Σ Monthly KW = 901

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility ELECTRIC DEMAND

Peak Value 81.8 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	38.9	47.61
Sub Total			38.9	47.61
Heating Equipment				
1	EQ2002	GAS FIRE TUBE STEAM	1.0	1.19
Sub Total			1.0	1.19
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	13.1	15.97
Sub Total			13.1	15.97
Sub Total			0.0	0.00
Miscellaneous				
Lights			7.7	9.41
Base Utilities			0.0	0.00
Misc Equipment			21.1	25.82
Sub Total			28.8	35.23
Grand Total			81.8	100.00

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**                                                                            **
**              T R A C E   6 0 0   A N A L Y S I S                           **
**                                                                            **
**              by            **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 23642
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT PER SOW: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 20:19:15 3/ 3/92
Dataset Name: 23642A .TM

System 1 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

Peaked at Time ==> Mo/Hr: 7/16 * Mo/Hr: 6/16 * Mo/Hr: 13/ 1
Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 * OADB: 97 * OADB: 24

Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	43,919	0		43,919	34.25	44,277	47.13	-23,519	-23,519	26.20
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	9,987	0		9,987	7.79	9,672	10.30	-20,693	-20,693	23.05
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-3,334	-3,334	3.71
Infiltration	4,177			4,177	3.26	4,224	4.50	-8,713	-8,713	9.71
Sub Total==>	58,082	0		58,082	45.29	58,173	61.92	-56,260	-56,260	62.67
Internal Loads										
Lights	26,549	0		26,549	20.70	26,549	28.26	0	0	0.00
People	5,460			5,460	4.26	2,990	3.18	0	0	0.00
Misc	6,232	0	0	6,232	4.86	6,232	6.63	0	0	0.00
Sub Total==>	38,241	0	0	38,241	29.82	35,771	38.08	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	21,198	16.53	0	0.00	0	-44,221	49.26
Sup. Fan Heat				10,713	8.35		0.00		10,713	-11.93
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	96,323	0	0	128,234	100.00	93,944	100.00	-56,260	-89,768	100.00

----------------------------------COOLING COIL SELECTION----------------------------------

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	10.7	128.2	126.1	10,043	77.2	57.2	49.4	64.1	52.3	48.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	10.7	128.2								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	3,652		
Part	800		
ExFlr	97		
Roof	3,652	0	0
Wall	1,257	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-89.8	10,043	65.4	74.7
Aux Htg	0.0	0	0.0	0.0
Preheat	-25.0	10,043	65.4	68.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-89.8			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	1,004	1,004
Infil	198	198
Supply	10,043	10,043
Mincfm	0	0
Return	10,043	10,043
Exhaust	1,004	1,004
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	2.75
Clg Cfm/Ton	939.81
Clg Sqft/Ton	341.75
Clg Btuh/Sqft	35.11
No. People	13
Htg % OA	10.0
Htg Cfm/SqFt	2.75
Htg Btuh/SqFt	-24.58

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	65.2	75.9
Plenum	75.0	70.0
Return	75.0	70.0
Ret/OA	77.2	65.4
Runarnd	75.0	70.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 2 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK						CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>		Mo/Hr: 7/16				Mo/Hr: 7/17			Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				OADB: 96			OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	Space Sensible	Percnt Of Tot	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	43,919	0		43,919	33.53	42,027	40.03	-23,519	-23,519	28.10
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	11,201	0		11,201	8.55	13,406	12.77	-20,693	-20,693	24.72
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-3,334	-3,334	3.98
Infiltration	3,684			3,684	2.81	3,940	3.75	-8,713	-8,713	10.41
Sub Total==>	58,804	0		58,804	44.90	59,373	56.55	-56,260	-56,260	67.22
Internal Loads										
Lights	36,396	0		36,396	27.79	36,396	34.67	0	0	0.00
People	5,460			5,460	4.17	2,990	2.85	0	0	0.00
Misc	6,232	0	0	6,232	4.76	6,232	5.94	0	0	0.00
Sub Total==>	48,088	0	0	48,088	36.72	45,618	43.45	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	15,309	11.69	0	0.00	0	-36,205	43.26
Sup. Fan Heat				8,765	6.69		0.00		8,765	-10.47
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	106,892	0	0	130,966	100.00	104,990	100.00	-56,260	-83,700	100.00

-----COOLING COIL SELECTION-----

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	10.9	131.0	131.3	8,217	77.2	58.0	53.1	60.5	51.9	53.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	10.9	131.0								

-----AREAS-----

	Gross Total	Glass (sf)	(%)
Floor	3,652		
Part	1,360		
ExFlr	97		
Roof	3,652	0	0
Wall	1,257	0	0

-----HEATING COIL SELECTION-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-83.7	8,217	65.4	76.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-20.5	8,217	65.4	68.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-83.7			

-----AIRFLOWS (cfm)-----

Type	Cooling	Heating
Vent	822	822
Infil	198	198
Supply	8,217	8,217
Mincfm	0	0
Return	8,217	8,217
Exhaust	822	822
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	2.25
Clg Cfm/Ton	752.90
Clg Sqft/Ton	334.62
Clg Btuh/Sqft	35.86
No. People	13
Htg % OA	10.0
Htg Cfm/SqFt	2.25
Htg Btuh/SqFt	-22.92

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	61.7	77.2
Plenum	75.0	70.0
Return	75.0	70.0
Ret/OA	77.2	65.4
Runarnd	75.0	70.0
Fn MtrTD	0.4	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 3 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK ******************************** CLG SPACE PEAK ************ HEATING COIL PEAK ********

						*			*			
Peaked at Time ==>		Mo/Hr:	7/16			*	Mo/Hr: 7/19		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR:	97/ 64/ 49.0			*	OADB: 91		*		OADB: 24	
						*			*			
	Space	Ret. Air	Ret. Air	Net	Percnt	*	Space	Percnt	*	Space Peak	Coil Peak	Percnt
	Sens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensible	Of Tot	*	Space Sens	Tot Sens	Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	20,994	0		20,994	11.99	*	26,280	17.31	*	-35,245	-35,245	35.78
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-4,502	-4,502	4.57
Infiltration	2,535			2,535	1.45	*	1,707	1.12	*	-5,034	-5,034	5.11
Sub Total==>	23,529	0		23,529	13.44	*	27,987	18.43	*	-44,781	-44,781	45.46
Internal Loads						*			*			
Lights	20,977	0		20,977	11.98	*	20,977	13.81	*	0	0	0.00
People	1,260			1,260	0.72	*	690	0.45	*	0	0	0.00
Misc	3,567	0	0	3,567	2.04	*	3,567	2.35	*	0	0	0.00
Sub Total==>	25,804	0	0	25,804	14.74	*	25,234	16.62	*	0	0	0.00
Ceiling Load	0	0			0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	27,0[illegible]	5.46	*	0	0.00	*	0	-53,735	54.54
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	98,639			98,639	56.35	*	98,639	64.95	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
						*			*			
Grand Total==>	147,972	0	0	175,039	100.00	*	151,860	100.00	*	-44,781	-98,516	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity		Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR		
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains
Main Clg	14.6	175.0	173.4	12,200	77.2	56.9	47.8	60.1	51.2	51.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	14.6	175.0								

--------------AREAS--------------

	Gross Total	Glass (sf)	(%)
Floor	2,090		
Part	0		
ExFlr	131		
Roof	0	0	0
Wall	2,140	0	0

------------HEATING COIL SELECTION------------

	Capacity	Coil Airfl	Ent	Lvg
	(Mbh)	(cfm)	Deg F	Deg F
Main Htg	-130.0	12,200	62.7	73.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	12,200	65.4	60.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-130.0			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	1,220	1,220
Infil	114	114
Supply	12,200	12,200
Mincfm	0	0
Return	12,200	12,200
Exhaust	1,220	1,220
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	5.84
Clg Cfm/Ton	836.38
Clg Sqft/Ton	143.32
Clg Btuh/Sqft	83.73
No. People	3
Htg % OA	10.0
Htg Cfm/SqFt	5.84
Htg Btuh/SqFt	-62.19

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	62.0	73.8
Plenum	75.0	70.0
Return	75.0	70.0
Ret/OA	77.2	65.4
Runarnd	75.0	70.0
Fn MtrTD	0.6	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.5	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 23642

-------------------------------- B U I L D I N G   U - V A L U E S --------------------------------

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	NEW ADDITION - N	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
2	NEW ADDITION - S	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
System	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
3	ORIG. BLDG. - N	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
System	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Building		0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	42.2	8.96

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 23642

-- B U I L D I N G   A R E A S --

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	NEW ADDITION - N	1	1	3,652	3,652	800	97	0	0	3,652	0	0	1,257
Zone	1 Total/Ave.				3,652	800	97	0	0	3,652	0	0	1,257
System	1 Total/Ave.				3,652	800	97	0	0	3,652	0	0	1,257
2	NEW ADDITION - S	1	1	3,652	3,652	1,360	97	0	0	3,652	0	0	1,257
Zone	2 Total/Ave.				3,652	1,360	97	0	0	3,652	0	0	1,257
System	2 Total/Ave.				3,652	1,360	97	0	0	3,652	0	0	1,257
3	ORIG. BLDG. - N	1	1	2,090	2,090	0	131	0	0	0	0	0	2,140
Zone	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
System	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
Building					9,394	2,160	324	0	0	7,304	0	0	4,653

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 23642

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----				---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours		Cap. (Cfm)	Hours (%)	Hours
0 - 5	1.8	19	754	-17,446	17	349	1,523.0	0	0	1357	0.0	0	0
5 - 10	3.6	13	518	-34,893	15	307	3,046.0	0	0	1865	0.0	0	0
10 - 15	5.4	10	389	-52,339	12	261	4,569.0	0	0	2101	0.0	0	0
15 - 20	7.2	7	278	-69,785	11	221	6,092.0	0	0	2002	0.0	0	0
20 - 25	9.0	9	353	-87,232	10	216	7,615.0	0	0	3177	0.0	0	0
25 - 30	10.9	9	358	-104,678	9	194	9,138.0	0	0	3402	0.0	0	0
30 - 35	12.7	9	373	-122,124	11	233	10,661.0	0	0	4737	0.0	0	0
35 - 40	14.5	5	187	-139,571	10	215	12,184.0	0	0	2712	0.0	0	0
40 - 45	16.3	8	319	-157,017	2	50	13,707.0	0	0	5200	0.0	0	0
45 - 50	18.1	4	171	-174,463	0	7	15,230.0	0	0	3095	0.0	0	0
50 - 55	19.9	5	213	-191,910	0	6	16,753.0	0	0	4239	0.0	0	0
55 - 60	21.7	2	65	-209,356	2	37	18,276.0	94	8,256	1411	0.0	0	0
60 - 65	23.5	1	45	-226,802	0	7	19,799.0	0	0	1058	0.0	0	0
65 - 70	25.3	0	20	-244,249	0	0	21,322.0	0	0	506	0.0	0	0
70 - 75	27.1	0	0	-261,695	0	0	22,845.0	0	0		0.0	0	0
75 - 80	28.9	0	0	-279,141	0	0	24,368.0	0	0		0.0	0	0
80 - 85	30.8	0	0	-296,588	0	0	25,891.0	0	0		0.0	0	0
85 - 90	32.6	0	0	-314,034	0	0	27,414.0	0	0		0.0	0	0
90 - 95	34.4	0	0	-331,481	0	0	28,937.0	0	0		0.0	0	0
95 - 100	36.2	0	0	-348,927	0	0	30,460.0	6	504		0.0	0	0
Hours Off	0.0	0	4,717	0	0	6,657	0.0	0	0		0.0	0	8,760
										37,362			

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	28,238	85	260	0	3
Feb	24,822	80	224	0	3
March	24,340	78	38	2	2
April	23,243	90	0	7	0
May	30,378	94	0	19	0
June	33,920	99	0	27	0
July	35,824	100	0	30	0
Aug	36,333	99	0	29	0
Sept	29,643	96	0	18	0
Oct	24,715	90	0	7	0
Nov	23,321	78	60	1	2
Dec	26,730	78	162	0	2
Total	341,507	100	744	139	3

Building Energy Consumption = 131,991 (Btu/Sq Ft/Year) Floor Area = 9,394 (Sq Ft)
Source Energy Consumption = 132,236 (Btu/Sq Ft/Year)

Σ Monthly KW = 1,067

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-- U T I L I T Y   P E A K   C H E C K S U M S --

Utility   ELECTRIC DEMAND

Peak Value   99.8   (kW)
Yearly Time of Peak 10 (hr)   7 (mo)

Hour 10 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	36.9	36.96
Sub Total			36.9	36.96
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	7.5	7.52
2		SUMMATION OF FAN ELECTRICAL DEMAND	7.5	7.52
3		SUMMATION OF FAN ELECTRICAL DEMAND	18.6	18.65
Sub Total			33.6	33.68
Sub Total			0.0	0.00
Miscellaneous				
Lights			24.6	24.65
Base Utilities			0.0	0.00
Misc Equipment			4.7	4.71
Sub Total			29.3	29.36
Grand Total			99.8	100.00

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**                                                                            **
**               T R A C E   6 0 0   A N A L Y S I S                          **
**                                                                            **
**               by              **
**                                                                            **
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ESOS STUDY AT WSMR - BUILDING 23642
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT PER SOW: ALT 1-BSLN, ALT2-ECO (MODIFIED CONFIGURATION)

Weather File Code:	ELPASO.W	
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 9:36:21 6/19/92
Dataset Name: 23642 .TM

System 1 Peak SZ - SINGLE ZONE

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 6/16		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 97		OADB: 24		
	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Envelope Loads										
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	43,919	0		43,919	39.79	44,277	50.91	-23,519	-23,519	30.31
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	9,987	0		9,987	9.05	9,672	11.12	-20,693	-20,693	26.67
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-3,334	-3,334	4.30
Infiltration	4,349			4,349	3.94	4,224	4.86	-8,713	-8,713	11.23
Sub Total==>	58,255	0		58,255	52.78	58,173	66.89	-56,260	-56,260	72.51
Internal Loads										
Lights	19,569	0		19,569	17.73	19,569	22.50	0	0	0.00
People	5,460			5,460	4.95	2,990	3.44	0	0	0.00
Misc	6,232	0	0	6,232	5.65	6,232	7.17	0	0	0.00
Sub Total==>	31,261	0	0	31,261	28.32	28,791	33.11	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	14,048	12.73	0	0.00	0	-28,145	36.28
Sup. Fan Heat				6,817	6.18		0.00		6,817	-8.79
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	89,516	0	0	110,380	100.00	86,964	100.00	-56,260	-77,587	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	9.2	110.4	107.4	6,391	77.2	56.9	48.1	59.7	50.1	47.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	9.2	110.4								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	3,652		
Part	800		
ExFlr	97		
Roof	3,652	0	0
Wall	1,257	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-77.6	6,391	65.4	78.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-15.9	6,391	65.4	68.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-77.6			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	639	639
Infil	198	198
Supply	6,391	6,391
Mincfm	0	0
Return	6,391	6,391
Exhaust	639	639
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	10.0
Clg Cfm/Sqft	1.75
Clg Cfm/Ton	694.80
Clg Sqft/Ton	397.03
Clg Btuh/Sqft	30.22
No. People	13
Htg % OA	10.0
Htg Cfm/SqFt	1.75
Htg Btuh/SqFt	-21.25

TEMPERATURES (F)

Type	Clg	Htg
SADB	60.8	79.2
Plenum	75.0	70.0
Return	75.0	70.0
Ret/OA	77.2	65.4
Runarnd	75.0	70.0
Fn MtrTD	0.2	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 2 Peak SZ - SINGLE ZONE

************************* COOLING COIL PEAK					*******************	*	CLG SPACE PEAK	*********	*	HEATING COIL PEAK	********	
Peaked at Time ==>		Mo/Hr: 7/16				*	Mo/Hr: 7/17		*		Mo/Hr: 13/ 1	
Outside Air ==>		OADB/WB/HR: 97/ 64/ 49.0				*	OADB: 96		*		OADB: 24	
	Space Sens.+Lat.	Ret. Air Sensible	Ret. Air Latent	Net Total	Percnt Of Tot	*	Space Sensible	Percnt Of Tot	*	Space Peak Space Sens	Coil Peak Tot Sens	Percnt Of Tot
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	43,919	0		43,919	38.04	*	42,027	44.00	*	-23,519	-23,519	30.31
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	11,201	0		11,201	9.70	*	13,406	14.03	*	-20,693	-20,693	26.67
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	-3,334	-3,334	4.30
Infiltration	3,523			3,523	3.05	*	3,940	4.12	*	-8,713	-8,713	11.23
Sub Total==>	58,643	0		58,643	50.79	*	59,373	62.16	*	-56,260	-56,260	72.51
Internal Loads						*			*			
Lights	26,923	0		26,923	23.32	*	26,923	28.19	*	0	0	0.00
People	5,460			5,460	4.73	*	2,990	3.13	*	0	0	0.00
Misc	6,232	0	0	6,232	5.40	*	6,232	6.52	*	0	0	0.00
Sub Total==>	38,615	0	0	38,615	33.45	*	36,145	37.84	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	11,381	9.86	*	0	0.00	*	0	-28,145	36.28
Sup. Fan Heat				6,817	5.90	*		0.00	*		6,817	-8.79
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	-0.00	*	0	-0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	97,258	0	0	115,456	100.00	*	95,518	100.00	*	-56,260	-77,587	100.00

-----------------------------------COOLING COIL SELECTION-----------------------------------

	Total Capacity (Tons)	Total Capacity (Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Entering Deg F	Entering Grains	Leaving DB/WB/HR Deg F	Leaving Deg F	Leaving Grains
Main Clg	9.6	115.5	116.0	6,391	77.2	58.3	54.3	58.3	51.3	54.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	9.6	115.5								

-------------AREAS-------------

	Gross Total	Glass (sf)	(%)
Floor	3,652		
Part	1,360		
ExFlr	97		
Roof	3,652	0	0
Wall	1,257	0	0

------------HEATING COIL SELECTION------------

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-77.6	6,391	65.4	78.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-15.9	6,391	65.4	68.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-77.6			

--------AIRFLOWS (cfm)--------

Type	Cooling	Heating
Vent	639	639
Infil	198	198
Supply	6,391	6,391
Mincfm	0	0
Return	6,391	6,391
Exhaust	639	639
Rm Exh	0	0
Auxil	0	0

--ENGINEERING CHECKS--

Clg % OA	10.0
Clg Cfm/Sqft	1.75
Clg Cfm/Ton	664.25
Clg Sqft/Ton	379.57
Clg Btuh/Sqft	31.61
No. People	13
Htg % OA	10.0
Htg Cfm/SqFt	1.75
Htg Btuh/SqFt	-21.25

--TEMPERATURES (F)---

Type	Clg	Htg
SADB	59.4	79.2
Plenum	75.0	70.0
Return	75.0	70.0
Ret/OA	77.2	65.4
Runarnd	75.0	70.0
Fn MtrTD	0.2	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.8	0.0

System 3 Peak SZ - SINGLE ZONE

	COOLING COIL PEAK					CLG SPACE PEAK		HEATING COIL PEAK		
Peaked at Time ==>	Mo/Hr: 7/16					Mo/Hr: 7/19		Mo/Hr: 13/ 1		
Outside Air ==>	OADB/WB/HR: 97/ 64/ 49.0					OADB: 91		OADB: 24		
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percnt Of Tot (%)	Space Sensible (Btuh)	Percnt Of Tot (%)	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percnt Of Tot (%)
Skylite Solr	0	0		0	0.00	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	0	0.00	0	0	0.00
Roof Cond	0	0		0	0.00	0	0.00	0	0	0.00
Glass Solar	0	0		0	0.00	0	0.00	0	0	0.00
Glass Cond	0	0		0	0.00	0	0.00	0	0	0.00
Wall Cond	20,994	0		20,994	37.34	26,280	57.72	-35,245	-35,245	57.87
Partition	0			0	0.00	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	0	0.00	-4,502	-4,502	7.39
Infiltration	2,446			2,446	4.35	1,707	3.75	-5,034	-5,034	8.27
Sub Total==>	23,439	0		23,439	41.70	27,987	61.47	-44,781	-44,781	73.53
Internal Loads										
Lights	16,268	0		16,268	28.94	16,268	35.73	0	0	0.00
People	1,260			1,260	2.24	690	1.52	0	0	0.00
Misc	3,567	0	0	3,567	6.35	3,567	7.83	0	0	0.00
Sub Total==>	21,095	0	0	21,095	37.53	20,525	45.08	0	0	0.00
Ceiling Load	0	0		0	0.00	0	0.00	0	0	0.00
Outside Air	0	0	0	7,832	13.93	0	0.00	0	-16,121	26.47
Sup. Fan Heat				6,828	12.15		0.00		0	0.00
Ret. Fan Heat		0		0	0.00		0.00		0	0.00
Duct Heat Pkup		0		0	0.00		0.00		0	0.00
OV/UNDR Sizing	-2,979			-2,979	-5.30	-2,979	-6.54	0	0	0.00
Exhaust Heat		0	0	0	0.00		0.00		0	0.00
Terminal Bypass		0	0	0	0.00		0.00		0	0.00
Grand Total==>	41,555	0	0	56,216	100.00	45,533	100.00	-44,781	-60,901	100.00

COOLING COIL SELECTION

	Total Capacity (Tons)	(Mbh)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR Deg F	Deg F	Grains	Leaving DB/WB/HR Deg F	Deg F	Grains
Main Clg	4.7	56.2	55.6	3,658	77.2	57.1	48.9	60.1	51.1	50.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	4.7	56.2								

AREAS

	Gross Total	Glass (sf)	(%)
Floor	2,090		
Part	0		
ExFlr	131		
Roof	0	0	0
Wall	2,140	0	0

HEATING COIL SELECTION

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F
Main Htg	-130.0	3,658	45.7	82.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-0.0	3,658	65.4	60.1
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-130.0			

AIRFLOWS (cfm)

Type	Cooling	Heating
Vent	366	366
Infil	114	114
Supply	3,658	3,658
Mincfm	0	0
Return	3,658	3,658
Exhaust	366	366
Rm Exh	0	0
Auxil	0	0

ENGINEERING CHECKS

Clg % OA	10.0
Clg Cfm/Sqft	1.75
Clg Cfm/Ton	780.85
Clg Sqft/Ton	446.25
Clg Btuh/Sqft	26.89
No. People	3
Htg % OA	10.0
Htg Cfm/SqFt	1.75
Htg Btuh/SqFt	-62.19

TEMPERATURES (F)

Type	Clg	Htg
SADB	62.0	82.8
Plenum	75.0	70.0
Return	75.0	70.0
Ret/OA	77.2	65.4
Runarnd	75.0	70.0
Fn MtrTD	0.3	0.0
Fn BldTD	0.5	0.0
Fn Frict	1.5	0.0

BUILDING U-VALUES - ALTERNATIVE 2
ECO - 23642

BUILDING U-VALUES

Room Number	Description	Room U-Values (Btu/hr/sqft/F) Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
1	NEW ADDITION - N	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
2	NEW ADDITION - S	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
System	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
3	ORIG. BLDG. - N	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
System	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Building		0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	42.2	8.96

BUILDING AREAS - ALTERNATIVE 2
ECO - 23642

BUILDING AREAS

Room Number	Description	Number of Duplicate Flr	Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	NEW ADDITION - N	1	1	3,652	3,652	800	97	0	0	3,652	0	0	1,257
Zone	1 Total/Ave.				3,652	800	97	0	0	3,652	0	0	1,257
System	1 Total/Ave.				3,652	800	97	0	0	3,652	0	0	1,257
2	NEW ADDITION - S	1	1	3,652	3,652	1,360	97	0	0	3,652	0	0	1,257
Zone	2 Total/Ave.				3,652	1,360	97	0	0	3,652	0	0	1,257
System	2 Total/Ave.				3,652	1,360	97	0	0	3,652	0	0	1,257
3	ORIG. BLDG. - N	1	1	2,090	2,090	0	131	0	0	0	0	0	2,140
Zone	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
System	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
Building					9,394	2,160	324	0	0	7,304	0	0	4,653

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2
ECO - BUILDING 23642

-- S Y S T E M   L O A D   P R O F I L E --

System Totals

Percent Design Load	---- Cooling Load ----			------ Heating Load ------			---- Cooling Airflow -----			---- Heating Airflow -----		
	Cap. (Ton)	Hours (%)	Hours	Capacity (Btuh)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours	Cap. (Cfm)	Hours (%)	Hours
0 - 5	1.2	18	705	-15,849	15	389	822.0	0	0	0.0	0	0
5 - 10	2.4	12	486	-31,699	15	377	1,644.0	0	0	0.0	0	0
10 - 15	3.5	7	294	-47,548	13	338	2,466.0	0	0	0.0	0	0
15 - 20	4.7	7	260	-63,397	13	326	3,288.0	0	0	0.0	0	0
20 - 25	5.9	4	174	-79,247	12	305	4,110.0	0	0	0.0	0	0
25 - 30	7.1	5	193	-95,096	10	251	4,932.0	0	0	0.0	0	0
30 - 35	8.2	4	165	-110,945	10	260	5,754.0	0	0	0.0	0	0
35 - 40	9.4	6	243	-126,795	8	207	6,576.0	0	0	0.0	0	0
40 - 45	10.6	3	117	-142,644	2	42	7,398.0	0	0	0.0	0	0
45 - 50	11.8	5	200	-158,494	2	48	8,220.0	0	0	0.0	0	0
50 - 55	12.9	4	155	-174,343	0	0	9,042.0	0	0	0.0	0	0
55 - 60	14.1	3	126	-190,192	0	0	9,864.0	0	0	0.0	0	0
60 - 65	15.3	5	195	-206,042	0	0	10,686.0	0	0	0.0	0	0
65 - 70	16.5	6	248	-221,891	0	0	11,508.0	0	0	0.0	0	0
70 - 75	17.6	3	127	-237,740	0	0	12,330.0	0	0	0.0	0	0
75 - 80	18.8	2	83	-253,590	0	0	13,152.0	63	5,562	0.0	0	0
80 - 85	20.0	2	91	-269,439	0	0	13,974.0	0	0	0.0	0	0
85 - 90	21.2	2	62	-285,288	0	0	14,796.0	6	504	0.0	0	0
90 - 95	22.3	1	59	-301,138	0	0	15,618.0	0	0	0.0	0	0
95 - 100	23.5	0	0	-316,987	0	0	16,440.0	31	2,694	0.0	0	0
Hours Off	0.0	0	4,777	0	0	6,217	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	24,528	55	282	0	1
Feb	21,397	55	222	0	1
March	19,691	66	84	0	1
April	18,669	70	0	5	1
May	25,075	71	0	16	0
June	28,795	73	0	24	0
July	31,119	75	0	28	0
Aug	31,074	74	0	27	0
Sept	25,105	71	0	16	0
Oct	19,753	70	0	5	1
Nov	19,362	66	105	0	1
Dec	22,937	55	185	0	1
Total	287,506	75	878	123	1

Building Energy Consumption = 113,801 (Btu/Sq Ft/Year)   Floor Area = 9,394 (Sq Ft)
Source Energy Consumption = 114,090 (Btu/Sq Ft/Year)

Σ Monthly KW = 801

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

---------- U T I L I T Y   P E A K   C H E C K S U M S ----------

Utility ELECTRIC DEMAND

Peak Value 74.7 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	34.8	46.59
Sub Total			34.8	46.59
Sub Total			0.0	0.00
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	5.6	7.50
2		SUMMATION OF FAN ELECTRICAL DEMAND	5.6	7.50
3		SUMMATION OF FAN ELECTRICAL DEMAND	5.6	7.50
Sub Total			16.8	22.50
Sub Total			0.0	0.00
Miscellaneous				
Lights			18.4	24.62
Base Utilities			0.0	0.00
Misc Equipment			4.7	6.29
Sub Total			23.1	30.91
Grand Total			74.7	100.00

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TECH AREA CHILLER PLANT

E M C ENGINEERS, INC.
Denver • Colorado Springs • Atlanta • West Germany

JOB WSMR ESOS STUDY #1110-000
SHEET NO. 2 OF 3
CALCULATED BY TF DATE 3/31/92
CHECKED BY DATE
SCALE

FROM TRACE 600 RUNS ON ALT #1 & ALT #2

MONTHLY MAXIMUM ON PEAK ELEC. DEMAND (KW)

	CHW PUMP	COND. WATER PUMP	CHILLERS & COOLING TOWER	SUM OF MONTHLY ON PEAK KW
ALT #1	471.6	306	3,044	3,831
ALT #2	471.6	0	0	1,214

FROM TRACE
MONTHLY AND
ANNUAL UTILITY
REPORT SUMMARIES

E M C ENGINEERS, INC.	JOB WSMR ESOS STUDY #1110-000
Denver • Colorado Springs • Atlanta • West Germany	SHEET NO. ______ OF ______
	CALCULATED BY TF DATE 7/12/92
	CHECKED BY ______ DATE ______
	SCALE ______

TECH AREA BASELINE
ELECTRICAL USAGE

FROM INDIVIDUAL BLDG TRACE 600 RUNS:

BLDG.	KWH	Σ KW	GAS.
P1506	655,601	3,707	776.1
P1512	1,286,045	2,809	66.6
P1526	1,043,946	2,283	674.5
P1528	543,627	1,420	298.1
P1530	1,002,336	3,070	922.2
P1621	302,686	971	96.2
P1622/23	992,994	2,709	881.0
P1624	855,490	2,710	100.2
TOTAL	6,682,725	19,679	3,815

JOB

SHEET NO. 1 OF 1

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY Alan Niemeyer DATE 4-1-92

CHECKED BY DATE

SCALE

TECH CENTER EQUIPMENT REPLACEMENT & MAINTENANCE COST SUMMARY

TECH CENTER BASELINE REPLACEMENT COST SUMMARY:

YEAR 1 : $100,000

YEAR 5 : $193,500

YEAR 10 : $713,250

TECH CENTER BASELINE MAINTENANCE COST SUMMARY:

YEAR 1 : $3,000

YEAR 5 : $5,805

YEAR 10 : $21,398

ITEM	RECURRING MAINT. COST ($/YR)	NON-RECURRING COSTS		
		YEAR OF REPLACEMENT	REPLACEMENT COST ($)	MAINTENANCE COST ($)
BASELINE	30,203	1	100,000	3,000
		5	193,500	5,805
		10	713,250	21,398
ALT 1	—	1	0	50,420
ALT 2	—	1	0	71,346
ALT 3	—	1	0	126,574
ALT 4	—	1	0	131,786

DIFFERENTIAL COSTS (BASELINE − ALTERNATIVE)

ITEM	RECURRING COSTS	NON RECURRING COSTS	
		YEAR	$
ALT 1 Central Chiller Plant	−20,217	1	100,000
		5	193,500
		10	713,250
ALT 2 Central Chiller PLT w/Thermal Stor.	−41,143	1	−100,000 + 167,960* = 267,960
		5	193,250
		10	713,250
ALT 3 Central Chiller Plt/Cogen Plt (Cent)	−96,371	1	100,000
		5	193,500
		10	713,250
ALT 4 Central Chiller PLT Cogen. PLT (Absorption)	−101,583	1	+100,000
		5	193,500
		10	713,500

* Utility Rebate for KW Shift: 884 KW × $190 = $167,960

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE ~~1~~ BASELINE P1506

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	44,083	124	2,743	9
Feb	39,818	124	1,990	8
March	44,604	147	423	4
April	45,290	166	0	1
May	61,279	203	0	0
June	71,830	220	0	0
July	78,442	223	0	0
Aug	77,510	220	0	0
Sept	60,425	201	0	0
Oct	47,842	182	0	0
Nov	41,083	123	623	4
Dec	43,395	124	1,982	7
Total	655,601	223	7,761	9

Building Energy Consumption = 87,746 (Btu/Sq Ft/Year)   Floor Area = 34,346 (Sq Ft)
Source Energy Consumption = 88,444 (Btu/Sq Ft/Year)

Σ monthly KW = 3,707

MONTHLY ENERGY CONSUMPTION BASELINE

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	85,767	202	270	3	4
Feb	78,782	203	165	5	3
March	96,605	213	31	21	2
April	100,600	232	0	38	0
May	122,311	238	0	69	0
June	127,978	241	0	89	0
July	131,267	246	0	101	0
Aug	135,338	245	0	100	0
Sept	122,125	240	0	72	0
Oct	109,669	233	0	43	0
Nov	89,264	209	40	19	3
Dec	86,340	207	160	7	3
Total	1,286,045	246	666	567	4

Building Energy Consumption = 111,440 (Btu/Sq Ft/Year)   Floor Area = 39,984 (Sq Ft)
Source Energy Consumption = 111,492 (Btu/Sq Ft/Year)

Σ monthly kW = 2,809

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

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PAGE 1

BLDG. 1526

MONTHLY ENERGY CONSUMPTION - BASELINE

---------- MONTHLY ENERGY CONSUMPTION ----------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	77,804	146	2,257	8
Feb	70,197	146	1,664	7
March	78,873	165	512	4
April	79,731	187	0	1
May	93,682	214	0	0
June	99,795	237	0	0
July	109,089	242	0	0
Aug	107,256	238	0	0
Sept	92,024	215	0	0
Oct	82,722	186	0	0
Nov	75,203	161	680	4
Dec	77,570	146	1,631	5
Total	1,043,946	242	6,745	8

Building Energy Consumption = 172,563 (Btu/Sq Ft/Year) Floor Area = 24,556 (Sq Ft)
Source Energy Consumption = 173,412 (Btu/Sq Ft/Year)

Σ monthly KW = 2,283

BLDG. 1528

MONTHLY ENERGY CONSUMPTION - BASELINE

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	36,905	109	821	11	3
Feb	32,836	112	641	11	3
March	41,217	111	312	23	2
April	42,815	120	55	30	1
May	50,662	121	0	50	0
June	54,427	124	0	61	0
July	56,045	127	0	71	0
Aug	58,273	126	0	71	0
Sept	50,726	123	0	53	0
Oct	46,242	118	97	34	1
Nov	36,863	110	376	18	2
Dec	36,616	109	679	13	3
Total	543,627	127	2,981	445	3

Building Energy Consumption = 86,742 (Btu/Sq Ft/Year) Floor Area = 24,827 (Sq Ft)
Source Energy Consumption = 87,113 (Btu/Sq Ft/Year)

Σ monthly kw = 1,420

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLDG 1530 BASELINE

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	75,189	209	3,756	11
Feb	68,225	209	2,559	10
March	74,803	203	217	5
April	68,489	230	0	0
May	87,489	289	0	0
June	107,842	330	0	0
July	111,255	335	0	0
Aug	112,459	325	0	0
Sept	83,340	284	0	0
Oct	72,773	244	0	0
Nov	68,148	203	374	5
Dec	72,323	209	2,316	8
Total	1,002,336	335	9,222	11

Building Energy Consumption = 53,167 (Btu/Sq Ft/Year)   Floor Area = 81,689 (Sq Ft)
Source Energy Consumption = 53,516 (Btu/Sq Ft/Year)

Σ monthly kW = 3,070

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	19,305	57	452	3
Feb	17,232	57	272	2
March	19,595	54	0	1
April	24,428	99	0	0
May	34,860	115	0	0
June	40,919	135	0	0
July	43,200	135	0	0
Aug	42,438	133	0	0
Sept	33,339	110	0	0
Oct	25,706	97	0	0
Nov	17,784	54	4	1
Dec	18,741	57	234	2
Total	337,547	135	962	3

Building Energy Consumption = 63,554 (Btu/Sq Ft/Year)   Floor Area = 19,641 (Sq Ft)
Source Energy Consumption = 63,705 (Btu/Sq Ft/Year)

Σ monthly kw= 971

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

B. 1622-23

MONTHLY ENERGY CONSUMPTION - BASELINE

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	GAS DMND On Peak (Thrm/hr)
Jan	73,978	188	3,235	9
Feb	66,893	188	2,316	9
March	75,090	188	309	4
April	69,732	186	0	0
May	89,759	260	0	0
June	99,677	285	0	0
July	105,737	288	0	0
Aug	105,207	282	0	0
Sept	85,990	246	0	0
Oct	76,251	222	0	0
Nov	71,352	188	654	5
Dec	73,327	188	2,297	7
Total	992,994	288	8,810	9

Building Energy Consumption = 113,678 (Btu/Sq Ft/Year)   Floor Area = 37,563 (Sq Ft)
Source Energy Consumption = 114,404 (Btu/Sq Ft/Year)

Σ monthly kW = 2,709

BLDG. 1624

MONTHLY ENERGY CONSUMPTION - BASELINE

------------------------------------ M O N T H L Y   E N E R G Y   C O N S U M P T I O N ------------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	46,224	158	520	0	6
Feb	41,749	201	281	0	6
March	57,731	220	0	20	0
April	68,501	233	0	48	0
May	88,392	241	0	94	0
June	94,585	249	0	122	0
July	97,242	254	0	138	0
Aug	100,590	252	0	135	0
Sept	88,716	243	0	97	0
Oct	74,689	234	0	53	0
Nov	50,767	219	0	15	0
Dec	46,304	206	200	2	4
Total	855,490	254	1,002	724	6

Building Energy Consumption = 73,520 (Btu/Sq Ft/Year)   Floor Area = 41,076 (Sq Ft)
Source Energy Consumption = 73,596 (Btu/Sq Ft/Year)

Σ monthly kW = 2,710

JOB WSMR ESOS STUDY #1110-000

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

SHEET NO. 1 OF 5

CALCULATED BY TF DATE 3/27/91

CHECKED BY DATE

SCALE

TECH AREA HEATING
LOAD CALCS

FT. BLISS Wx DATA Base = 50°F

ΔT	TEMP. BIN (°F)	Jan	Feb.	MAR	APR	OCT	NOV	DEC	TOT. HRS
		← HOURS OF OBSERVATION →							
2.5	45-49	113	101	94	41	35	109	114	607
7.5	40-44	113	87	63	15	13	95	114	500
12.5	35-39	103	73	43	1	1	64	109	394
17.5	30-34	75	50	20			30	90	265
22.5	25-29	43	27	9			13	43	135
27.5	20-24	21	12	1			2	14	50
32.5	15-19	8	6					3	17
37.5	10-15	4	1					1	6
42.5	5-9	2							2
	TOT.	482	357	230	57	49	313	488	1976
	HDD:	240	161	76	10	9	111	241	848 = TOT HDD.

FROM TRANE TRACE SIMULATIONS OF BLDGS IN THE TECH AREA, THE CROSSOVER OUTSIDE AIR TEMPERATURE FOR HEATING IS ABOUT 50°F. THE # HDD/YR BASED ON A 50° CROSSOVER TEMP. IS CALCULATED ABOVE FROM THE ARMY TM 5-785 ENGINEERING WEATHER DATA FOR FORT BLISS, TX.

JOB

SHEET NO. 5 OF 5

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SCALE

MONTHLY COOLING LOAD CALCULATION. (TON-HRS) FROM TRACE 600 BLDG. MODELS.

ANNUAL TECH AREA COOLING LOAD = 1,251,743 TON-HRS

ANNUAL BASELINE CHILLED WATER EQUIPMT ELECTRICAL CONSUMPTION = 1,411,650 KWH

ALLOCATE THE ANNUAL TON-HR LOAD TO MONTHS USING MONTHLY FRACTION OF CHILLED WATER EQUIPMENT ANNUAL KW-MO. (FROM TRANE TRACE MODEL)

MONTHLY PEAK KW FOR CHW EQUIPMENT

BLDG.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV.	DEC
1506	0	0	18.9	53.9	87.7	92.6	95.5	93.0	86.2	54.9	7.2	0
1512	31.5	31.6	38.6	57.4	62.8	66.2	70.9	70.1	65.1	82.9	37.3	93.5
1526	20.1	20.6	40.5	62.6	79.2	81.8	142.3	137.3	77.4	61.1	36.3	20.3
1528	23.2	26.4	29.2	36.3	39.2	41.3	45.3	44.2	40.7	36.2	28.1	24.6
1530	0	0	0	19.5	78.9	150.5	151.8	146.2	73.6	63.8	0	0
1621	0	0	18.9	31.4	42.9	54.0	55.0	54.4	40.8	30.2	19.3	0
1622/23	19.1	19.2	19.4	21.2	83.4	138.7	142.2	135.1	81.1	56.9	19.4	19.1
1624	0	31.7	52.0	64.9	72.9	81.3	85.7	83.7	75.2	66.2	50.8	38.0
TOTAL	93.9	130.0	217.5	347.2	547	706.4	788.2	764	540.1	452.2	198.4	195.5

$\sum$ KW-MO = 4980.4 $\frac{\#\text{ TON-HRS}}{\text{KW-MO}} = \frac{1,251,743 \text{ TON-HR}}{4980.4 \text{ KW-MO}} = 251.3 \frac{\text{TON HR}}{\text{KW MO}}$

MONTHLY TON-HRS COOLING LOAD = $\frac{251.3 \text{ TON-HR}}{\text{KW-MO}} \times$ # KW-MO.

1000 TON-HR.	23.6	32.7	54.7	87.3	137.5	177.5	198.1	192.0	135.7	113.6	49.9	49.1
MBTU	283	392	656	1,048	1,650	2,130	2,377	2,304	1,628	1,363	599	589

→ Use as chw load on COGEN ALT #3 + ALT #4

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF 6

E M C ENGINEERS, INC.

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CALCULATED BY TF DATE 11-04-92

CHECKED BY DATE

SCALE

TECH AREA CONSOLIDATED CHILLED WATER PLANT

DAILY COOLING LOAD PROFILES

SOURCE: TRACE CONSOLIDATED LOAD RUN (MBtu/hr)

HR.	JAN	APR	JUL	OCT
1	0	0.283	2.523	0.291
2	0	0.251	2.219	0.243
3	0.039	0.221	1.883	0.215
4	0.063	0.215	1.639	0.213
5	0.063	0.214	1.490	0.212
6	0.063	0.212	1.381	0.210
7	0.197	0.313	1.792	0.289
8	0.225	0.385	2.403	0.334
9	0.256	0.762	3.824	0.505
10	0.309	1.113	4.756	1.034
11	0.352	1.326	5.612	1.241
12	0.385	2.061	6.211	1.529
13	0.392	2.748	6.493	2.925
14	0.427	3.027	6.716	3.326
15	0.442	3.218	6.824	3.622
16	0.460	3.345	6.927	3.977
17	0.623	2.951	6.464	3.454
18	0.528	2.934	6.002	3.121
19	0.433	2.623	5.685	2.803
20	0.263	1.756	4.775	1.754
21	0.212	1.395	4.284	1.210
22	0.206	1.051	3.822	0.871
23	0.203	0.789	3.301	0.632
24	0.200	0.625	2.905	0.515
DAILY AVERAGE	0.264	1.111	4.164	1.439
ON PEAK AVERAGE	0.431	2.599	6.171	2.775

ON PEAK ELECTRICAL DEMAND PERIOD

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 2 OF 6

CALCULATED BY TF DATE 11-04-92

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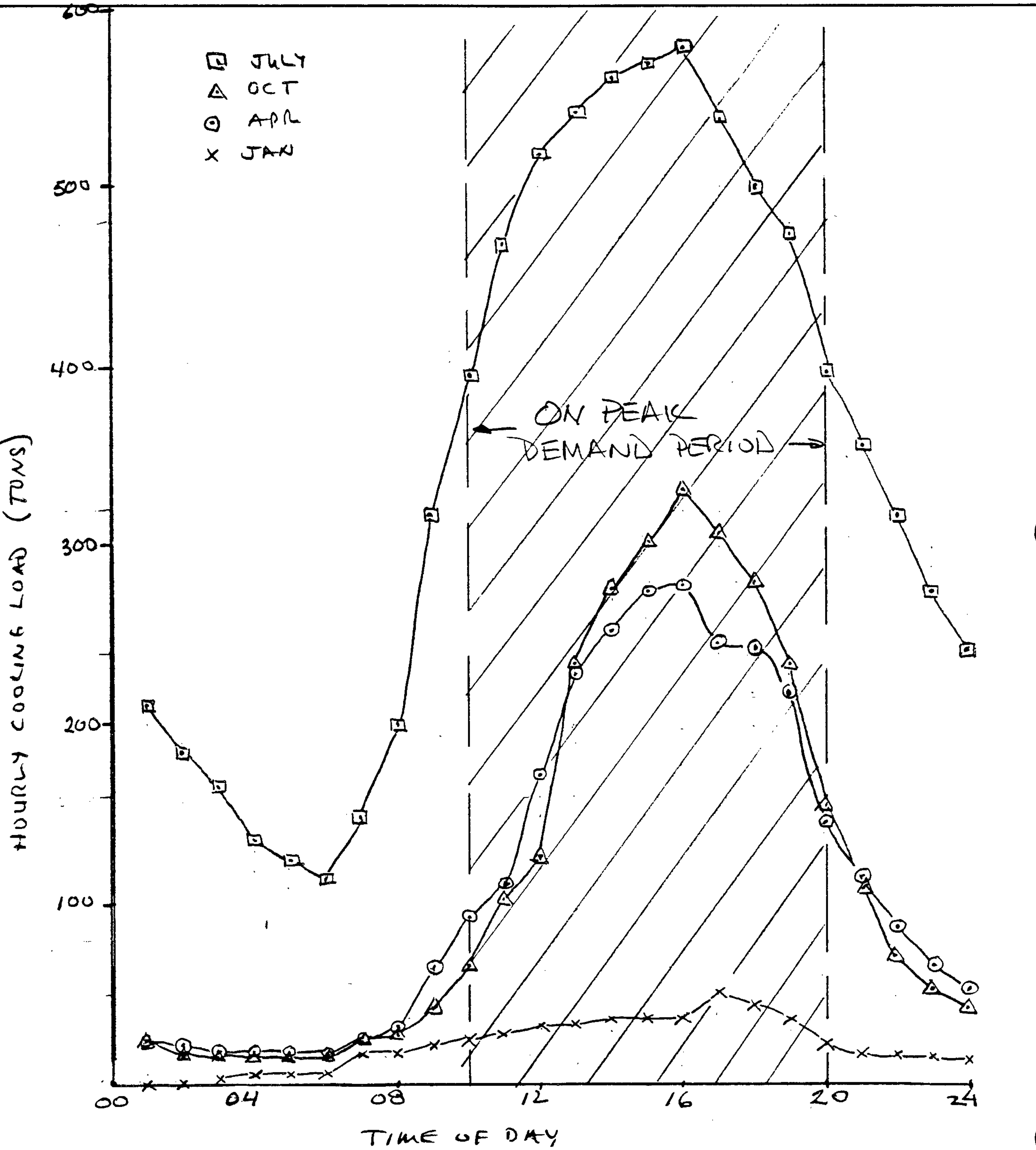
TECH AREA CONSOLIDATED COOLING LOAD



SOURCE: TRACE CONSOLIDATED COOLING LOAD COMPUTER RUN

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SHEET NO. 3 OF 6

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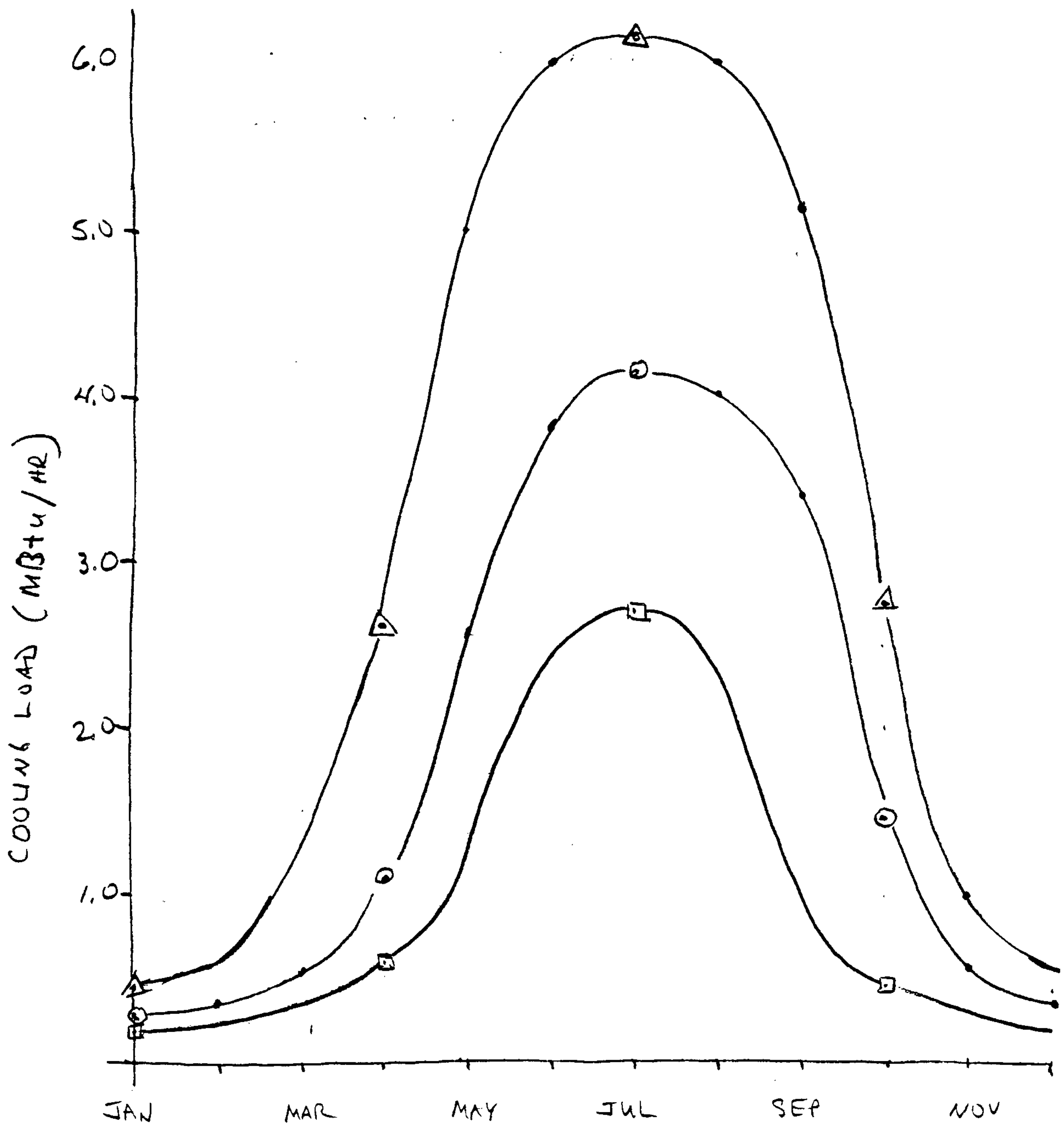
TECH AREA CONSOLIDATED COOLING LOAD (AVERAGES)



⊙ DAILY AVERAGE

△ ON PEAK AVERAGE

□ OFF PEAK AVERAGE

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 4 OF 6

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SCALE

TECH AREA SPACE HEAT LOAD *

FOR 27 BLDGS (MBtu/hr)

HR	JAN	FEB	MAR	APR	SEP	OCT	NOV	DEC
1	4.519	3.233	0.833	0	0	0.028	0.116	0.252
2	5.073	3.737	1.121	0.012		0.047	0.197	0.565
3	5.563	4.101	1.462	0.037		0.065	0.215	1.665
4	6.022	4.541	1.791	0.059		0.097	0.225	2.409
5	6.377	4.732	2.066	0.071		0.108	0.565	2.770
6	6.524	5.555	2.228	0.101		0.124	0.914	3.463
7	6.721	4.948	2.122	0.207		0	1.089	3.615
8	4.880	4.361	1.625	0.183			1.600	3.146
9	2.801	2.250	0.079	0			0.418	1.726
10	1.775	1.237	0				0	0.760
11	0.739	0.410						0.091
12	0.272	0.049						0.012
13	0.041	0						0
14	0							
15								
16								
17								
18								
19								
20	0.055							
21	0.254							0.014
22	0.565	0.112						0.116
23	1.688	0.370	0.022					0.498
24	2.965	0.900	0.085					1.241
DAILY AVE (MBtu/hr)	2.40	1.740	0.563	0.028	0	0.020	0.222	0.963
ON PEAK AVE (MBtu/hr)	0.111	0.046	0	0	0	0	0	0.010

ON PEAK

* NINE BLDGS WERE SIMULATED ON TRACE 600 AND CONSOLIDATED INTO A HEATING LOAD. THE RESULTS WERE SCALED BY TOTAL FLOOR AREA THAT IS HEATED IN THE 27 BLDGS IN THE TECH AREA.

JOB

SHEET NO. 5 OF 6

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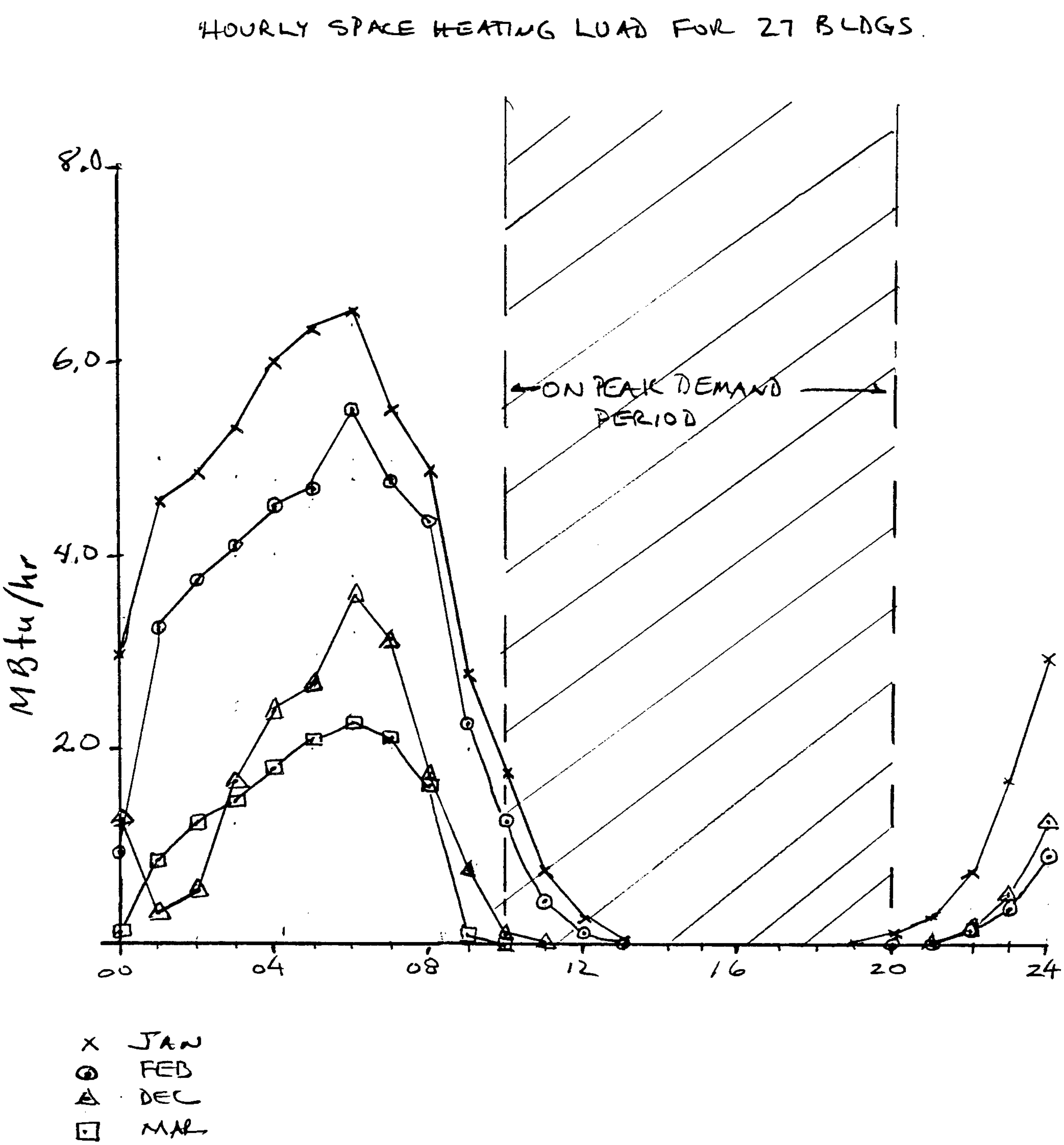
SCALE

TECH AREA HEATING LOAD.



JOB	WSMR ESOS STUDY #1110-000
SHEET NO.	6 OF 6
CALCULATED BY	TF — DATE 11-05-92
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SCALE	

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TECH AREA STEAM LOADS.

ALT #3 & ALT #4

SPACEHEATING & PROCESS LOADS

NOTE: FROM ECO #10 ANALYSIS, PROCESS LOAD FOR THE TECH AREA IS 0.500 MBtu/HR FROM 0800 to 1700 DAILY.

$$\text{DAILY AVE. STEAM LOAD (LB/HR)} = \left(\frac{\text{MONTHLY DAILY AVE.} \times 24 + 8 \times 0.5}{24 \times 869.6\ \text{BTU/LB}}\right) 10^6$$

$$\text{ONPEAK AVE STEAM LOAD (LB/HR)} = \left(\frac{\text{ONPEAK AVE} \times 10 + 6 \times 0.5}{10 \times 869.6}\right) 10^6$$

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DAILY AVE STM RATE (LB/HR)	2951.5	2192.5	839	223.9	191.7	→				214.7	446.9	1299.1
ONPEAK AVE STM RATE (LB/HR)	472.6	397.9	345	345	345	345	345	345	345	345	345	356.5
OFF PEAK AVE RATE (LB/HR)	4,722	3474.4	1191.8	137.4	82.2	→				121.6	519.7	1,972.4

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	White Sands Missile Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
PROJECT TITLE:	TECH AREA CHILLER PLANT (ALT 1)			FISCAL YEAR:	1992
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	07/13/92	ECONOMIC LIFE:	25	PREPARED BY:	A. NIEMEYER

1 INVESTMENT

A. CONSTRUCTION COST	=		$1,680,663	
B. SIOH COST	(5.5% of 1A) =		$92,436	
C. DESIGN COST	(6.0% of 1A) =		$100,840	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$1,873,939	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		---------->	$1,873,939

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	7,654	$49,557	15.23	$754,749	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	0	$0	19.64	$0	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		7,654	49,556.7		---------->	$754,749

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS + MAINTENANCE COST SAVINGS)	=		$98,285	
1 DISCOUNT FACTOR	(From Table A-2) =	14.68		
2 DISCOUNTED SAVINGS (+) / COST (–)	(3A x 3A1) =		$1,442,816	

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$100,000	1	0.96	$96,000
b. EQUIP REPLACEMENT COST	$193,500	5	0.80	$154,800
c. EQUIP REPLACEMENT COST	$713,250	10	0.64	$456,480
d TOTAL	$1,006,750			$707,280

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–)	(3A2 + 3Bd4) =		$2,150,096
D. PROJECT NON-ENERGY TEST			
1 25% MAXIMUM NON-ENERGY CALCULATION	(2F5 x 0.33) =	$249,067	
a IF 3D1 => 3C THEN GO TO 4			
b IF 3D1 < 3C THEN CALCULATE SIR	(2F5 + 3D1) / 1F =	0.54	
c IF 3D1b => 1 THEN GO TO 4			
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			

THIS ECO FAILS THE ECIP PROJECT NON-ENERGY TEST

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$188,111
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$2,904,846
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.55
7 SIMPLE PAYBACK (SPB)	(1F/4) =	9.96

	JOB	WSMR ESOS STUDY #1110-000
E M C ENGINEERS, INC.	SHEET NO.	OF
Denver • Colorado Springs • Atlanta • West Germany	CALCULATED BY	TF DATE 7/12/92
	CHECKED BY	DATE
	SCALE	

ALT # 1 ENERGY SAVINGS SUMMARY

	(KWH)	(ΣKW)	ELECTRICAL SAVINGS (KWH)	ELECTRICAL SAVINGS (KW)	ANN. MAINT SAVINGS ($/yr)
BASELINE	6,682,725*	19,679*	—	—	—
ALT # 1	4,440,255*	13,602*	2,242,470	6,077	-20,217

* FROM TRACE 600 RUNS

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR
EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed)
TECH AREA (ALT 1)

PROPOSED TOTAL CONTRACT PRICE

PURCHASE REQUEST NUMBER

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	175 TON CENTRIF. CHILLER & TOWER 375 TON CENTRIF. CHILLER & TOWER	LUMP SUM	1	275000	275000					$275,000.00
2	PUMPS, VALVES, ETC.	LUMP SUM	1	160600	160600					$160,600.00
3	1600 SQ.FT. BLDG.	SF	1600	30.00	48000					$48,000.00
4	BURIED CWS & CWR PIPING	LUMP SUM	1	558700	558700					$558,700.00
5	VAULT W/EXP. JOINTS, VALVES, ENCHORS, ETC	EA	5	10800	54000					$54,000.00
6	INTERCONNECTION @ BLDG.	EA	9	14000	126000					$126,000.00
	SUBTOTAL									$1,222,300.00
	OVERHEAD & PROFIT (25%)									$305,575.00
	CONTINGENCY (10%)									$152,787.50
	TOTAL THIS SHEET									$1,680,662.50

E M C ENGINEERS, INC.

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TECH AREA
ALT. 1

JOB WSMR ESOS STUDY #1110.000

SHEET NO. 1 OF

CALCULATED BY C. Butler DATE 3.17.92

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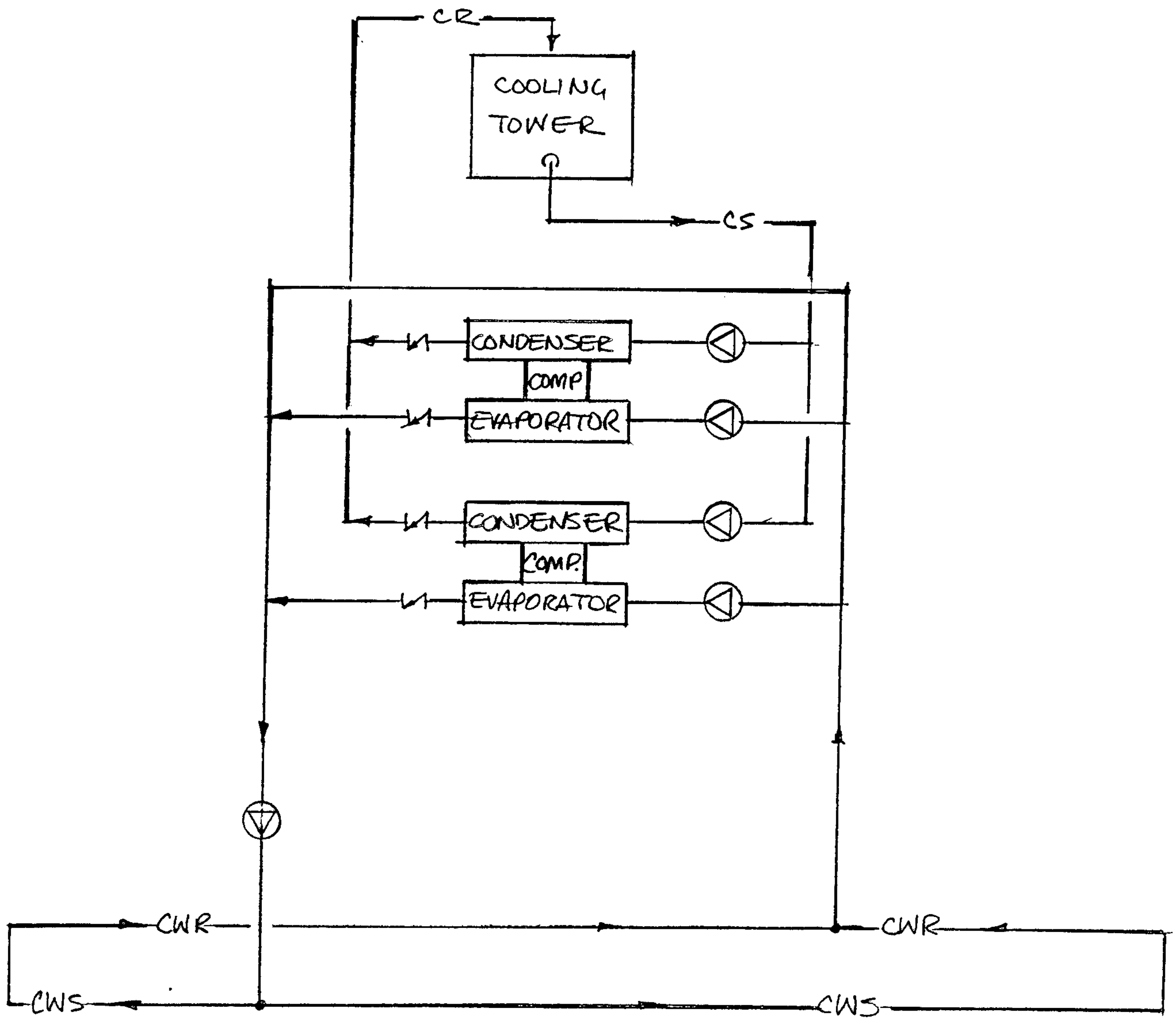
SCHEMATIC



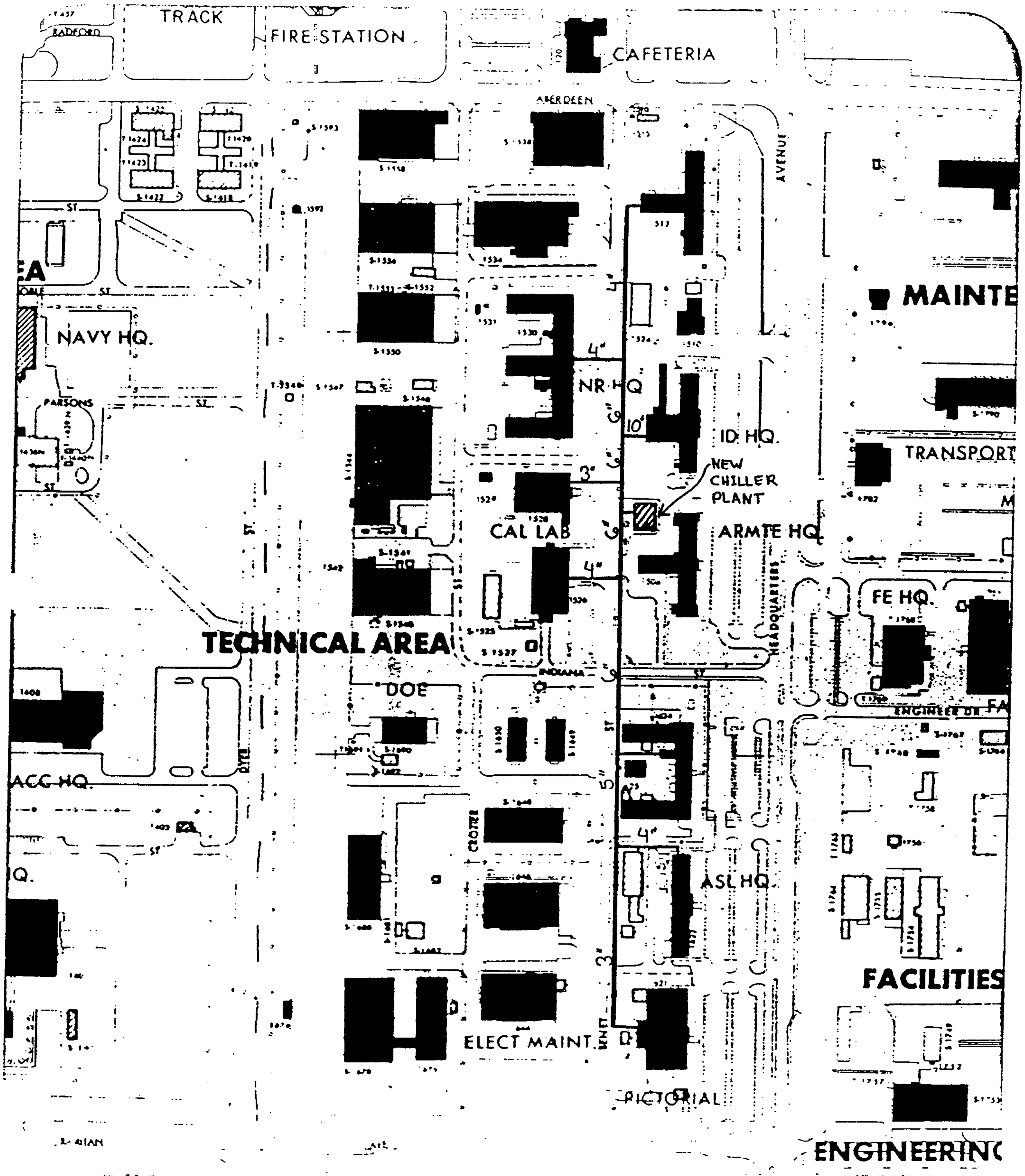


FIG 8-5
CHILLEDWATER DISTRIBUTION PIPING

JOB WSMR ESDS STUDY # 1110.000

SHEET NO. ______ OF ______

E M C ENGINEERS, INC.

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CHECKED BY AN DATE 3.20.92

SCALE ______

TECH AREA
ALT. 1

PROJECTED COST OF COMPLETE SYSTEM: (INSTALLED)

*1- ~~2~~ 3 75 T CENTRIF. CHILLER & TOWER } 550 ~~450~~ T x $500/T.	=	275,000 ~~225,000~~
*1- 175 T " " "		
2- 420 GPM CENTRIF PUMP, VALVES, ETC. x 20.2$/GPM	=	17,000
2- 660 GPM " " " "	=	27,000
* 2- 525 GPM " " " "	=	21,200
2- 825 GPM " " " "	=	33,300
2- 1536 GPM " " " "		62,100
*BLDG. 1600 Sq ft @ $30/Sq ft	=	48,000
BURIED CWS & CWR PIPING (INSULATED CONDUIT W/CATH. PROTN)		
10" 50' @ $275/LF		13,800
* 8" 1440' @ $230./LF		331,200
6" 650' @ $190/LF		123,500
5" 336' @ $165/LF		55,400
4" 240' @ $145/LF		34,800
*5- VAULT W/ EXP. JOINTS, VALVES, ANCHORS, ETC. @ 10,800 EA		54,000
*9- INTERCONNECTION @ BLDG. @ 14000 EA		126,000
		$ ~~1,172,300~~ 1,222,300

1. COSTS ARE COMPOSITE FIGURES USING EXTRAPOLATED EQUIPMENT QUOTES & INSTALLATION DATA FROM BOTH MEANS ESTIMATING GUIDE AND RICHARDSON ESTIMATING GUIDE.
2. ABOVE COSTS CONTAIN MATERIAL, LABOR & EQUIPMENT VALUES BUT <u>DO NOT</u> CONTAIN OVERHEAD OR PROFIT

MANUFACTURER	DUNHAM-BUSH	TRANE	TRANE
CHILLER	3 STAGE SCREW	1 STAGE SCREW	3 STAGE CENTRIFUGAL
CHILLER DRIVE	ELECTRIC	ELECTRIC	ELECTRIC
MAX. OUTPUT TONS	500	300	500
MAX. OUTPUT MBH	6,000	3,600	6,000
MAX. INPUT KW (KW/TON)	330(.66)	231(.77)	358(.716)
MAX. RECOVERABLE HEAT MBH	0	0	0
% OF MAX TO START	10	10	10
ELEC. ACCESS. KW (KW/TON)	60(.12)	36(.12)	60(.12)
% ACCESS. TO VARY WITH LOAD	40	40	40
CONDENSER WATER RANGE F	60 - 80	60 - 80	60 - 80
AVAILABLE SIZES TONS	130 - 900	100 - 300	100 - 1830
CORRISPONDING FULL LOAD INPUT KW/TON		.8 - .75	.87 - .68

Note: MBH = 10^3 BTUH

% LOAD	% INPUT	% RECV.	% LOAD	% INPUT	% RECV.	% LOAD	% INPUT	% RECV.
10	11	0	10	17	0	10	12	0
20	13	0	20	19	0	20	17	0
30	18	0	30	23	0	30	23	0
40	24	0	40	29	0	40	32	0
50	36	0	50	37	0	50	41	0
60	45	0	60	46	0	60	50	0
70	55	0	70	57	0	70	59	0
80	70	0	80	69	0	80	70	0
90	82	0	90	83	0	90	83	0
100	100	0	100	100	0	100	95	0

MANUFACTURER	YORK	TRANE	CARRIER
CHILLER	1 STAGE CENTRIFUGAL	SE ABSORPTION	SE ABSORPTION
CHILLER DRIVE	ELECTRIC	240 F HOT WATER	STEAM
MAX. OUTPUT TONS	500	500	500
MAX. OUTPUT MBH	6,000	6,000	6,000
MAX. INPUT MBH OR KW(INPUT/TON)	350(.7)	8,750(17.5)	9,062(18.12)
MAX. RECOVERABLE HEAT MBH	0	0	0
% OF MAX TO START	10	10	10
ELEC. ACCESS. KW (KW/TON)	60(.12)	80(.16)	80(.16)
% ACCESS. TO VARY WITH LOAD	40	40	40
CONDENSER WATER RANGE F	60 - 80	60 - 80	85
AVAILABLE SIZES TONS	150 - 1000	100 - 1660	
CORRESPONDING FULL LOAD INPUT PER TON	.74 - .73	17.5 - 17.1	

% LOAD	% INPUT	% RECV.	% LOAD	% INPUT	% RECV.	% LOAD	% INPUT	% RECV.
10	18	0	10	12	0	10	9	0
20	22	0	20	16	0	20	17	0
30	27	0	30	23	0	30	27	0
40	33	0	40	31	0	40	34	0
50	40	0	50	40	0	50	42	0
60	47	0	60	49	0	60	53	0
70	56	0	70	60	0	70	65	0
80	67	0	80	70	0	80	76	0
90	78	0	90	82	0	90	87	0
100	91	0	100	94	0	100	100	0

NOTE. ALL VAPOR COMPRESSION CHILLERS HAVE 10% FOULING PENALTY INCLUDED IN INPUT DATA
FULL LOAD INPUTS ARE FOR MEDIUM EFFICIENCY ON ALL CHILLERS

MANUFACTURER	TRANE	HITACHI	TECOCHILL
CHILLER	DE ABSORPTION	DE ABSORPTION	SCREW INCL. ECONOMIZER
CHILLER DRIVE	STEAM	DIRECT FIRED*	GAS ENGINE
MAX. OUTPUT TONS	500	500	150
MAX. OUTPUT MBH	6,000	6,000	1,800
MAX. INPUT MBH OR KW(INPUT/TON)	6,150(12.3)	(LHV) 5,868(11.74)	(LHV) 1,245(8.3)
MAX. RECOVERABLE HEAT MBH	0	0	659
% OF MAX TO START	10	30	10
ELEC. ACCESS. KW (KW/TON)	80(.16)	70(.14)	20(.13)
% ACCESS. TO VARY WITH LOAD	40	40	40
CONDENSER WATER RANGE F	60 - 80	65 - 80	60 - 80
AVAILABLE SIZE TONS	385 - 1000	100 - 1500	
CORRISPONDING FULL LOAD INPUT PER TON	12.3 - 11.9	11.74 - 11.72	

% LOAD	% INPUT	% RECV.	% LOAD	% INPUT	% RECV.	% LOAD	% INPUT	% RECV
10	9	0	10	16	0	10	9	10
20	15	0	20	22	0	20	17	18
30	22	0	30	28	0	30	23	24
40	30	0	40	34	0	40	31	32
50	38	0	50	43	0	50	40	42
60	46	0	60	51	0	60	48	50
70	56	0	70	62	0	70	60	62
80	67	0	80	71	0	80	71	72
90	78	0	90	83	0	90	87	87
100	94	0	100	95	0	100	100	100

* INPUT AS ENGINE CHILLER IN PC-CUBE

BOILERS AND HEATERS

MANUFACTURER	GENERIC	GENERIC	PK THERMIFIC	HITACHI
BURNER TYPE	ATMOSPHERIC	POWER	POWER	POWER
MAX. OUTPUT MBH	30,128	7,532	1,292	6,000
MAX. INPUT MBH(HHV)	37,661	9,415	1,520	7,434
ELEC. ACCESS. KW (+ PUMPS IF REQUIRED)	0	3.7	0.75	3.0

% LOAD	% INPUT	% INPUT	% INPUT	% INPUT
10	19.0	17.7	14.0	25.0
20	29.0	26.2	23.0	32.0
30	37.0	34.7	32.0	40.0
40	45.0	42.6	41.0	49.0
50	54.0	51.9	50.5	56.0
60	63.0	60.0	60.50	64.0
70	72.0	70.0	70.0	72.0
80	81.0	80.0	80.0	81.0
90	90.0	90.0	90.0	90.0
100	100.0	100.0	100.0	100.0

TECH AREA: ALT #1

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

NO STORAGE
CW PUMP - 39.3 KW
COND. PUMP - 25.5 KW
CHILLER - 0.8 KW/TON

V 60
PAGE

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	WATER (1000 Gl)
Jan	313,076	926	66
Feb	283,973	942	64
March	336,592	1,018	116
April	330,126	1,115	209
May	408,007	1,256	500
June	448,891	1,322	721
July	470,093	1,346	846
Aug	481,842	1,329	804
Sept	397,007	1,257	515
Oct	357,012	1,145	237
Nov	305,983	1,000	101
Dec	307,652	946	75
Total	4,440,255	1,346	4,255

Σ monthly KW = 13,602

Building Energy Consumption = 49,903 (Btu/Sq Ft/Year)
Source Energy Consumption = 149,723 (Btu/Sq Ft/Year)

Floor Area = 303,682 (Sq Ft)

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

V 600
PAGE

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 TECH AREA

E Q U I P M E N T   E N E R G Y   C O N S U M P T I O N

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS													
	ELEC	120688	109398	131064	115768	125876	125571	116073	131064	115768	125876	114623	116073	1,447,841
	PK	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7
1	MISC LD													
	ELEC	126100	114063	130921	121513	128511	126105	123918	130921	121513	128511	121056	123918	1,497,052
	PK	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5	MISC LD													
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1001S 2-STG CTV <555 TONS													
	ELEC	17254	16100	24048	30945	41107	50723	58891	59953	44908	30542	21745	18404	414,620
	PK	37.0	46.0	110.8	111.0	112.8	121.7	129.3	124.1	125.4	114.7	93.6	46.2 Σ=1173	129.3
1	EQ5100 COOLING TOWER													
	ELEC	78	194	1604	4561	8000	10208	10548	10548	10208	6591	1182	301	64,025
	PK	4.1	6.8	13.1	14.2	14.2	14.2	14.2	14.2	14.2	14.2	12.3	6.9 Σ=142.6	14.2
1	EQ5100 COOLING TOWER													
	WATER	66	64	116	167	237	296	328	335	252	164	101	75	2,201
	PK	0.2	0.3	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.3	0.7
1	EQ5001 CHILLED WATER PUMP C.V.													
	ELEC	29239	26410	29239	28296	29239	28296	29239	29239	28296	29239	28296	29239	344,268
	PK	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3 Σ=471.6	39.3
1	EQ5010 CONDENSER WATER PUMP C.V.													
	ELEC	18972	17136	18972	18360	18972	18360	18972	18972	18360	18972	18360	18972	223,380
	PK	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5 Σ=306	25.5

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

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PAGE 3

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

1 EQ5300	CONTRL PANEL & INTERLOCK.														
ELEC		744	672	744	720	744	720	744	744	720	744	720	744	8,760 ✓	
PK		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	Σ=12 12
2 EQ1001S	2-STG CTV <555 TONS														
ELEC		0	0	0	7453	44638	73656	93946	84836	46721	12552	0	0	363,802 ✓	
PK		0.0	0.0	0.0	119.5	215.8	260.7	277.0	265.9	216.7	140.0	0.0	0.0	277.0	Σ=1496 12
2 EQ5100	COOLING TOWER														
ELEC		0	0	0	2431	10573	14765	17196	15069	10178	3858	0	0	74,070 ✓	
PK		0.0	0.0	0.0	30.4	30.4	30.4	30.4	30.4	30.4	30.4	0.0	0.0	30.4	Σ=213 212
2 EQ5100	COOLING TOWER														
WATER		0	0	0	43	263	425	517	469	264	73	0	0	2,053	
PK		0.0	0.0	0.0	0.7	1.3	1.4	1.5	1.4	1.2	0.9	0.0	0.0	1.5	
2 EQ5001	CHILLED WATER PUMP C.V.														
ELEC		0	0	0	0	0	0	0	0	0	0	0	0	0	
PK		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2 EQ5010	CONDENSER WATER PUMP C.V.														
ELEC		0	0	0	0	0	0	0	0	0	0	0	0	0	
PK		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2 EQ5300	CONTROL PANEL & INTERLOCK														
ELEC		0	0	0	80	348	486	566	496	335	127	0	0	2,438 ✓	
PK		1.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	1.0	Σ=7 12
1 EQ4000	PREVENTS FAN ENERGY														
ELEC		0	0	0	0	0	0	0	0	0	0	0	0	0	
PK		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Σ kw/month = 3831

JOB WSMR ESOS STUDY # 1110-000

SHEET NO. 1 OF 2

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY C. B[illegible] DATE 3.6.92

CHECKED BY DATE

SCALE

~~TECHNICAL~~ AREA
CHILLED WATER LOOP

SIZE	GPM	LENGTH*	HD LOSS/100'	HD LOSS	ACCUM.
10"	1536	50	1.12	0.56	
6"	696	70	3.10	2.17	
6"	576	260	2.15	5.59	
6"	384	320	1.00	3.20	
4"	144	780	1.21	9.47	
				20.99	

~~10"~~	~~1536~~	~~50~~	~~1.12~~	~~0.56~~
~~6"~~	~~840~~	~~370~~	~~4.45~~	~~16.47~~
~~6"~~	~~600~~	~~820~~	~~2.33~~	~~19.11~~
~~5"~~	~~336~~	~~440~~	~~1.94~~	~~8.54~~
~~3"~~	~~96~~	~~1000~~	~~2.20~~	~~22.00~~
				~~66.67~~

10"	1536	50	1.12	0.56
8"	840	370	1.11	4.11
8"	600	820	0.59	4.84
5"	336	440	1.94	8.54
4"	96	1000	0.58	5.80
				23.85

LARGEST PIPING LOSS = 23.85 SAY 24.0
+ 10% FITTINGS. 2.4
+ ASSUME LOSS @ BLDG. 40.0
+ CHILLER & PIPING HD 20.0
86.4'
+ 10% CONTIN. 8.6
95.0'

*LENGTH IS BOTH SUPPLY + RETURN.

E M C ENGINEERS, INC.

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TECHNICAL AREA
CHILLED WATER LOOP.

JOB WSMR ESOS STUDY # 1110-007

SHEET NO. 2 OF 2

CALCULATED BY C. Butler DATE 3.6.92

CHECKED BY DATE

SCALE

PUMPING H.P.

$$BHP = \frac{GPM \times HD(ft) \times SP.GR.}{3960 \times \text{efficiency}}$$

$$= \frac{1536 \times 95 \times 1.044}{3960 \times 0.7}$$

$$= 54.96 \quad \text{SAY } 55 \text{ BHP.}$$

MOTOR HP:

55 BHP × 1.2* = 66 say 70 HP, 480V.

* 1.2 ALLOWS FOR BELT FRICTION LOSSES.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: TECH AREA CHILLER PLANT (ALT 2)   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 07/13/92   ECONOMIC LIFE: 25   PREPARED BY: A. NIEMEYER

1 INVESTMENT

A.	CONSTRUCTION COST	=	$2,378,200	
B.	SIOH COST	(5.5% of 1A) =	$130,801	
C.	DESIGN COST	(6.0% of 1A) =	$142,692	
D.	ENERGY CREDIT	(1A + 1B + 1C) =	$2,651,693	
E.	SALVAGE VALUE	=	$0	
F.	TOTAL INVESTMENT	(1D − 1E) =	--------->	$2,651,693

2 ENERGY SAVINGS (+) / COST (−)

	FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	$6.48	7,410	$47,979	15.23	$730,720	
B.	DIST		0	$0	17.28	$0	
C.	NAT GAS	$2.21	0	$0	19.64	$0	
D.	PAPER		0	$0		$0	
E.	COAL			$0	16.22	$0	
F.	TOTAL		7,410	47,979.0		--------->	$730,720

3 NON-ENERGY SAVINGS (+) / COST (−)

A. ANNUAL RECURRING (+/−) (ELEC. DEMAND SAVINGS + MAINTENANCE COST SAVINGS) = $123,223

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (−) (3A x 3A1) = $1,808,906

B. NON-RECURRING (+/−)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$267,960	1	0.96	$257,242
b. EQUIP REPLACEMENT COST	$193,500	5	0.80	$154,800
c. EQUIP REPLACEMENT COST	$713,250	10	0.64	$456,480
d TOTAL	$1,174,710			$868,522

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (−) (3A2 + 3Bd4) = $2,677,428

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = $241,138

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.37

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

THIS ECO FAILS THE ECIP PROJECT NON-ENERGY TEST

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (−)	(2F3 + 3A + (3B1d/25)) =	$218,190
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$3,408,148
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	1.29
7	SIMPLE PAYBACK (SPB)	(1F/4) =	12.15

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JOB WSMR ESOS STUDY #1110-000

SHEET NO. ________ OF ________

CALCULATED BY TF DATE 7/15/92

CHECKED BY ________ DATE ________

SCALE ________

ALT #2 ENERGY SAVINGS SUMMARY

			ELECTRICAL SAVINGS		MAINT. SAVINGS
	(KWH)	(KW)	(KWH)	(KW)	$/yr
BASELINE	6,682,725*	19,679*	—	—	
ALT #2	4,511,648*	11,250*	2,171,077	8,429	(41,143)

THE THERMAL STORAGE SHIFTS ALL CHW SYST. EQUIPMENT LOADS TO NIGHT EXCEPT FOR THE BLDG + PLANT CHW PUMPS;

THE UTILITY REBATE SHOULD BE THE MONTHLY AVE. REDUCTION IN DEMAND x $190 ;

$$\frac{8,429\text{ KW}}{12} \times \$190 = \$133,459 \text{ UTILITY REBATE.}$$

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): TECH AREA (ALT 2)

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
1	175 TON CENTRIF. CHILLER & TOWER 375 TON CENTRIF. CHILLER & TOWER	LUMP SUM	1	275000	275000					$275,000.00
2	PUMPS, VALVES, ETC.	LUMP SUM	1	160600	160600					$160,600.00
3	1600 SQ.FT. BLDG.	SF	1600	30.00	48000					$48,000.00
4	BURIED CWS & CWR PIPING	LUMP SUM	1	558700	558700					$558,700.00
5	VAULT W/EXP. JOINTS, VALVES, ANCHORS, ETC	EA	5	10800	54000					$54,000.00
6	INTERCONNECTION @ BLDG.	EA	9	14000	126000					$126,000.00
7	THERMAL STOR. TANK & CONNECTING PIPES	LUMP SUM	1	450000	450000					$450,000.00
8	THREE-WAY CONTROL VALVE, 6"	LUMP SUM	1	3300	3300					$3,300.00
9	VARIABLE SPEED PUMP DRIVE (70 HP)	LUMP SUM	1	54000	54000					$54,000.00
	SUBTOTAL									$1,729,600.00
	OVERHEAD & PROFIT (25%)									$432,400.00
	CONTINGENCY (10%)									$216,200.00
	TOTAL THIS SHEET									$2,378,200.00

JOB WSMR ESOS STUDY #1110.000

SHEET NO. 1 OF

E M C ENGINEERS, INC.

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CALCULATED BY C. Butler DATE 3.17.97

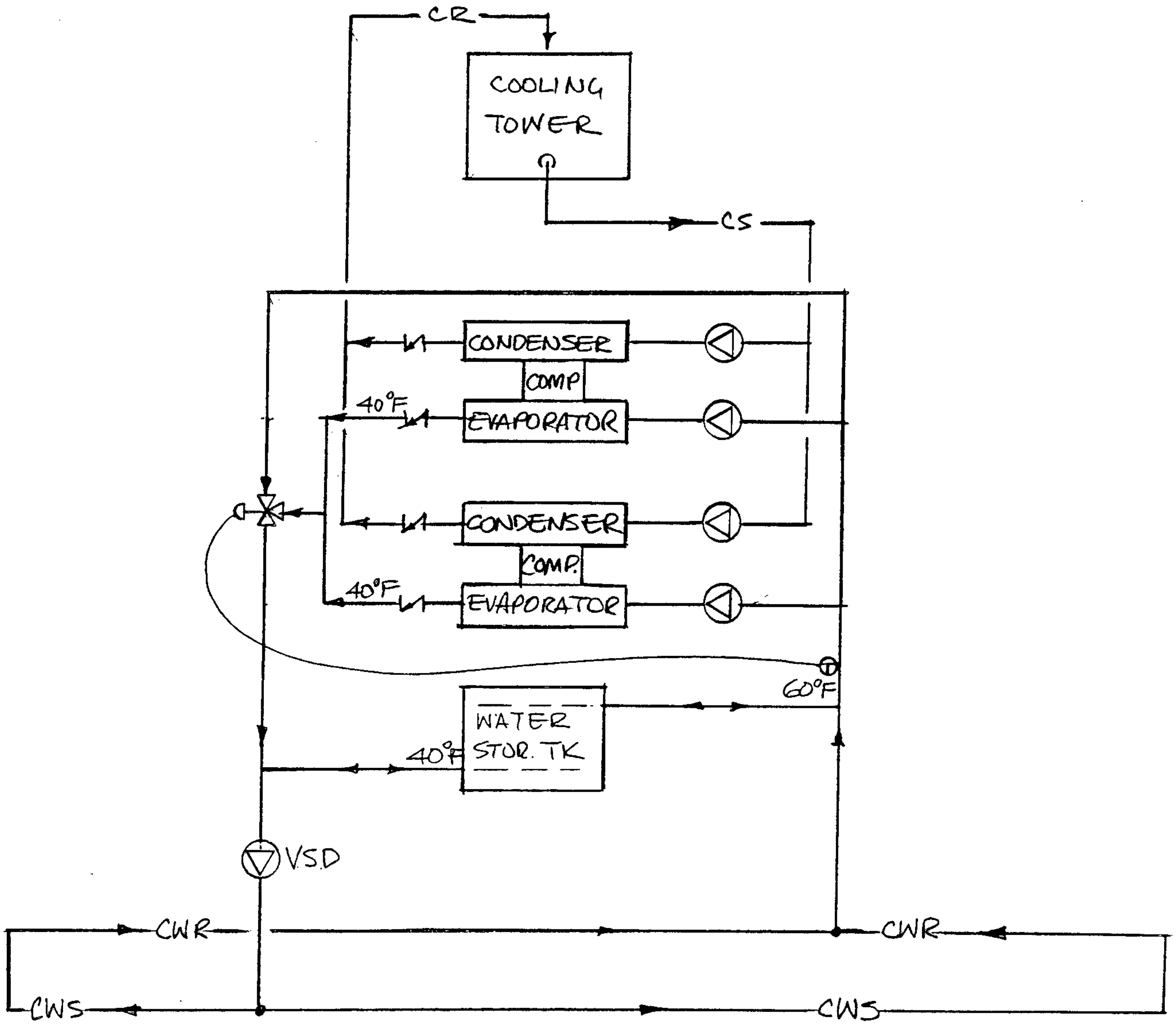
CHECKED BY DATE

SCALE

TECH AREA

ALT. 2

SCHEMATIC



JOB WSMR ESOS STUDY # 1110.000

E M C ENGINEERS, INC.

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SHEET NO. ______ OF ______

CALCULATED BY C. Butler DATE 3.17.92

CHECKED BY ______ DATE ______

SCALE ______

TECH AREA

ALT 2.

PROJECTED COST OF COMPLETE SYSTEM: (INSTALLED)

COST OF ALT. 1	1,172,300
*1- THERMAL STOR. TANK & CONNECTING PIPES	450,000
*1- THREE-WAY CONTROL VALVE, 6"	3,300
*2- VARIABLE SPEED PUMP DRIVE (70 HP.)	54,000
	# 1,679,600

JOB WSMR ESOS STUDY #1110.000

SHEET NO. ______ OF ______

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY C. Butler DATE 3.17.92

CHECKED BY TF DATE 3.19.92

SCALE ______

TECH AREA
ALT. 2.

THERMAL STORAGE TANK SIZING.

6000 TON-HR TANK
@ 13.5 Cuft / TON-HR. = 6000X13.5 = ~~444.4~~ 81,000 Cuft.

OPTIMUM HT OF TANK = 12 ft.

~~FOOTPRINT AREA OF TANK = 444.4 / 12 = 37. sq ft.~~

~~$A = \frac{\pi D^2}{4}$ OR $\sqrt{\frac{4A}{\pi}} = D = \sqrt{\frac{4(37)}{3.14}}$ = 6.87' SAY 7'ϕ~~

~~TANK DIMENSIONS : 7'ϕ x 12' HIGH.~~

COST FOR TANK & CONNECTIONS = $75/TON-HR x 6000 TON-HR
= $450,000

TANK DIMENSIONS:
76' X 76' X 14'

JOHN JANSEN - PACO 936-9989

TECH AREA ALT # 2

6000 TON-HRS STORAGE

PUMP - 39.3 KW

COND PUMP - 25.5 KW

CHILLER - 0.8 KW/TON/0.

(Discharge from STORAGE IS 7AM TO 6PM)

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2.

---------------------------------- M O N T H L Y   E N E R G Y   C O N S U M P T I O N ----------------------------

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	WATER (1000 Gl)	LITES + MISC EQUIPMT. ON PEAK DEMAND	ON PEAK CHW EQUIPMENT DEMAND
Jan	311,311	894	64	828.2	894 - 828.2 = 65.8 KW
Feb	282,470	894	62		894 - 828.2 = 65.8 KW
March	337,144	925	117		925 - 828.2 = 96.8 KW
April	330,373	931	212		931 - 828.2 = 102.8 KW
May	424,782	948	565		948 - 828.2 = 119.8 KW
June	466,381	963	765		963 - 828.2 = 134.8 KW
July	480,971	981	852		981 - 828.2 = 152.8 KW
Aug	497,259	977	828		977 - 828.2 = 148.8 KW
Sept	411,115	971	559		971 - 828.2 = 142.8 KW
Oct	357,497	946	241		946 - 828.2 = 117.8 KW
Nov	306,096	926	101		894 - 828.2 = 65.8 KW
Dec	306,247	894	73		
Total	4,511,648	981	4,441		TOTAL 1213.8 KW

Building Energy Consumption = 50,705 (Btu/Sq Ft/Year)
Source Energy Consumption = 152,131 (Btu/Sq Ft/Year)

Floor Area = 303,682 (Sq Ft)

Σ MONTHLY KW FOR CHW EQUIPMENT = 1213.8 KW

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

V 600
PAGE

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2   THERMAL STORAGE

EQUIPMENT ENERGY CONSUMPTION

Ref Num	Equip Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS													
	ELEC	120688	109398	131064	115768	125876	125571	116073	131064	115768	125876	114623	116073	1,447,841
	PK	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7	495.7
1	MISC LD													
	ELEC	126100	114063	130921	121513	128511	126105	123918	130921	121513	128511	121056	123918	1,497,052
	PK	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5	332.5
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH2O	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1001S	2-STG CTV <555 TONS												
	ELEC	12026	11047	15347	20139	39194	49766	56456	54875	40981	21782	14380	12278	348,272
	PK	126.1	126.1	127.6	128.9	134.3	138.8	144.5	143.3	141.9	134.3	127.9	127.6	Σ=1601 144.5
1	EQ5100	COOLING TOWER												
	ELEC	422	396	815	1678	4164	5529	5926	5714	5529	3077	694	417	34,363
	PK	13.6	13.6	13.6	14.2	14.2	14.2	14.2	14.2	14.2	14.2	13.6	13.6	Σ=167.4 14.2
1	EQ5100	COOLING TOWER												
	WATER	50	47	70	99	203	254	277	270	204	106	64	52	1,697
	PK	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
1	EQ5001	CHILLED WATER PUMP C.V.												
	ELEC	29239	26410	29239	28296	29239	28296	29239	29239	28296	29239	28296	29239	344,268
	PK	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	Σ=471.6 39.3
1	EQ5010	CONDENSER WATER PUMP C.V.												
	ELEC	18972	17136	18972	18360	18972	18360	18972	18972	18360	18972	18360	18972	223,380
	PK	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	Σ=306 25.5

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EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

1 EQ5300	CONTROL PANEL & INTERLOCK.														
ELEC	744	672	744	720	744	720	744	744	720	744	720	744		8,760 ✓
PK	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	Σ=12	1.0
2 EQ1001S	2-STG CTV <555 TONS													
ELEC	2753	2948	9072	21425	70216	100925	117310	113837	72134	26252	7310	4096		548,278 ✓
PK	158.6	215.8	273.3	276.2	287.8	297.4	309.7	307.0	304.1	287.8	274.2	242.5	Σ=3234.4	309.7
2 EQ5100	COOLING TOWER													
ELEC	334	373	916	2384	7609	10755	11940	11515	7565	2947	610	478		57,426 ✓
PK	22.4	26.9	29.2	30.4	30.4	30.4	30.4	30.4	30.4	30.4	29.1	28.2	Σ=348.6	30.4
2 EQ5100	COOLING TOWER													
WATER	14	15	47	113	363	511	575	558	355	135	37	21		2,744
PK	0.9	1.2	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.3		1.5
2 EQ5001	CHILLED WATER PUMP C.V.													
ELEC	0	0	0	0	0	0	0	0	0	0	0	0		0
PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
2 EQ5010	CONDENSER WATER PUMP C.V.													
ELEC	0	0	0	0	0	0	0	0	0	0	0	0		0
PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
2 EQ5300	CONTROL PANEL & INTERLOCK													
ELEC	31	28	54	90	256	354	393	379	249	97	46	31		2,008 ✓
PK	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	Σ=12	1.0
1 EQ4000	PREVENTS FAN ENERGY													
ELEC	0	0	0	0	0	0	0	0	0	0	0	0		0
PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0

~~Σ kW/mo peak = 6,153~~

TOTAL kW

~~Peak Demand. 388.4 449.9 510.5 516.5 533.5 547.6 565.6 561.7 557.4 533.5 511.6 478.7~~ 6,155

for CHW. equipment

COLD THERMAL STORAGE - ALTERNATIVE 2

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE ----

January

	Design		Design			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	32.8	22.9	0.0	0.0	0.0	6,000
2	31.5	21.9	0.0	0.0	0.0	6,000
3	30.4	20.9	3.2	0.0	0.0	6,000
4	29.6	20.4	5.2	5.2	6.6	6,000
5	29.4	20.0	5.2	5.2	6.6	6,000
6	29.9	20.7	5.2	5.2	6.6	6,000
7	31.2	22.0	16.4	16.4	20.8	6,000
8	33.6	24.0	18.8	0.0	0.0	5,981
9	37.0	26.5	21.4	0.0	0.0	5,960
10	40.9	28.5	25.7	0.0	0.0	5,934
11	45.4	30.7	29.3	0.0	0.0	5,905
12	49.6	34.1	32.0	0.0	0.0	5,873
13	52.7	36.1	32.6	0.0	0.0	5,840
14	54.8	36.7	35.5	0.0	0.0	5,805
15	55.6	37.2	36.8	0.0	0.0	5,768
16	54.8	36.8	38.3	0.0	0.0	5,729
17	53.0	35.6	51.9	0.0	0.0	5,678
18	50.1	34.0	44.0	0.0	0.0	5,634
19	46.7	31.7	36.1	402.6	284.7	6,000
20	43.3	29.9	21.9	21.9	24.0	6,000
21	40.4	28.1	17.7	17.7	22.3	6,000
22	37.8	26.4	17.1	17.1	21.8	6,000
23	35.7	24.9	16.9	16.9	21.5	6,000
24	34.1	23.9	16.6	16.6	21.1	6,000

	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	36.9	28.0	16.7	16.7	21.2	6,000	16.7	16.7	21.2	6,000
2	34.1	25.7	16.4	16.4	20.9	6,000	16.5	16.5	20.9	6,000
3	31.6	23.5	16.2	16.2	20.6	6,000	16.3	16.3	20.6	6,000
4	29.5	21.9	16.0	16.0	20.3	6,000	16.0	16.0	20.4	6,000
5	28.0	20.5	15.9	15.9	20.1	6,000	15.9	15.9	20.2	6,000
6	27.0	20.1	15.7	15.7	20.0	6,000	15.7	15.7	20.0	6,000
7	26.7	20.4	15.6	15.6	19.8	6,000	15.6	15.6	19.9	6,000
8	27.3	21.4	15.7	0.0	0.0	5,984	15.6	0.0	0.0	5,984
9	29.2	23.1	17.6	0.0	0.0	5,967	15.6	0.0	0.0	5,969
10	32.1	24.4	20.6	0.0	0.0	5,946	15.7	0.0	0.0	5,953
11	35.8	26.3	23.3	0.0	0.0	5,923	15.9	0.0	0.0	5,937
12	39.8	28.8	25.1	0.0	0.0	5,898	16.2	0.0	0.0	5,921
13	43.9	31.5	27.8	0.0	0.0	5,870	16.4	0.0	0.0	5,905
14	47.5	33.8	29.3	0.0	0.0	5,840	16.6	0.0	0.0	5,888

ALT. #2

15	50.4	35.9	31.9	0.0	0.0	5,809	16.9	0.0	0.0	5,871
16	52.3	37.3	33.2	0.0	0.0	5,775	17.1	0.0	0.0	5,854
17	52.9	37.7	33.9	0.0	0.0	5,741	17.3	0.0	0.0	5,837

COLD THERMAL STORAGE - ALTERNATIVE 2

	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
18	52.6	37.9	36.8	0.0	0.0	5,705	17.4	0.0	0.0	5,819
19	51.6	38.7	39.6	334.9	242.3	6,000	17.5	198.2	159.3	6,000
20	50.1	38.3	30.1	30.1	27.3	6,000	17.4	17.4	22.1	6,000
21	48.0	37.0	26.6	26.6	25.9	6,000	17.4	17.4	22.0	6,000
22	45.5	35.2	24.7	24.7	25.1	6,000	17.2	17.2	21.9	6,000
23	42.7	32.9	22.6	22.6	24.2	6,000	17.0	17.0	21.6	6,000
24	39.8	30.3	22.0	22.0	24.0	6,000	16.8	16.8	21.4	6,000

	Typical		Sunday				Monday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	36.9	28.0	16.7	16.7	21.1	6,000	16.6	16.6	21.1	6,000
2	34.1	25.7	16.5	16.5	20.9	6,000	16.4	16.4	20.9	6,000
3	31.6	23.5	16.3	16.3	20.6	6,000	16.2	16.2	20.6	6,000
4	29.5	21.9	16.0	16.0	20.4	6,000	16.0	16.0	20.3	6,000
5	28.0	20.5	15.9	15.9	20.2	6,000	15.9	15.9	20.1	6,000
6	27.0	20.1	15.7	15.7	20.0	6,000	15.7	15.7	19.9	6,000
7	26.7	20.4	15.6	15.6	19.9	6,000	15.6	15.6	19.8	6,000
8	27.3	21.4	15.6	0.0	0.0	5,984	15.7	0.0	0.0	5,984
9	29.2	23.1	15.6	0.0	0.0	5,969	17.6	0.0	0.0	5,967
10	32.1	24.4	15.7	0.0	0.0	5,953	20.6	0.0	0.0	5,946
11	35.8	26.3	15.9	0.0	0.0	5,937	23.3	0.0	0.0	5,923
12	39.8	28.8	16.2	0.0	0.0	5,921	25.1	0.0	0.0	5,898
13	43.9	31.5	16.4	0.0	0.0	5,905	27.8	0.0	0.0	5,870
14	47.5	33.8	16.6	0.0	0.0	5,888	29.3	0.0	0.0	5,841
15	50.4	35.9	16.9	0.0	0.0	5,871	31.9	0.0	0.0	5,809
16	52.3	37.3	17.1	0.0	0.0	5,854	33.2	0.0	0.0	5,775
17	52.9	37.7	17.3	0.0	0.0	5,837	33.9	0.0	0.0	5,741
18	52.6	37.9	17.4	0.0	0.0	5,819	34.1	0.0	0.0	5,707
19	51.6	38.7	17.5	198.2	159.3	6,000	34.1	326.8	237.6	6,000
20	50.1	38.3	17.4	17.4	22.1	6,000	21.6	21.6	23.8	6,000
21	48.0	37.0	17.4	17.4	22.0	6,000	18.6	18.6	22.6	6,000
22	45.5	35.2	17.2	17.2	21.9	6,000	17.2	17.2	21.8	6,000
23	42.7	32.9	17.0	17.0	21.6	6,000	17.0	17.0	21.6	6,000
24	39.8	30.3	16.8	16.8	21.4	6,000	16.8	16.8	21.3	6,000

COLD THERMAL STORAGE - ALTERNATIVE 2

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE ----

July

Hour	Design OADB (F)	Design OAWB (F)	Design Cooling Load (Ton)	Design Chiller Load (Ton)	Design Chiller Demand (kW)	Design Storage Capacity (Ton-Hr)
1	79.1	56.4	210.2	550.0	418.8	3,529
2	78.0	55.8	184.9	550.0	417.3	3,894
3	77.2	55.5	156.9	550.0	416.6	4,287
4	76.5	55.1	136.6	550.0	415.7	4,701
5	76.3	55.9	124.2	550.0	417.5	5,126
6	76.7	56.8	115.1	550.0	419.8	5,561
7	77.8	57.7	149.3	550.0	422.1	5,962
8	79.8	57.9	200.3	0.0	0.0	5,762
9	82.6	59.0	318.7	0.0	0.0	5,443
10	85.8	60.3	396.4	0.0	0.0	5,047
11	89.5	61.3	467.7	0.0	0.0	4,579
12	93.0	62.7	517.6	0.0	0.0	4,061
13	95.6	63.5	541.1	0.0	0.0	3,520
14	97.3	63.9	559.7	0.0	0.0	2,961
15	98.0	64.0	568.6	0.0	0.0	2,392
16	97.3	63.6	577.2	0.0	0.0	1,815
17	95.8	62.6	538.7	0.0	0.0	1,276
18	93.4	61.3	500.2	0.0	0.0	776
19	90.6	60.1	473.8	550.0	428.8	852
20	87.8	58.5	397.9	550.0	424.3	1,004
21	85.4	57.9	357.0	550.0	422.6	1,197
22	83.2	57.5	318.5	550.0	421.6	1,429
23	81.5	57.3	275.1	550.0	421.0	1,704
24	80.2	56.9	243.4	550.0	420.0	2,010

Hour	Typical OADB (F)	Typical OAWB (F)	Weekday Cooling Load (Ton)	Weekday Chiller Load (Ton)	Weekday Chiller Demand (kW)	Weekday Storage Capacity (Ton-Hr)	Saturday Cooling Load (Ton)	Saturday Chiller Load (Ton)	Saturday Chiller Demand (kW)	Saturday Storage Capacity (Ton-Hr)
1	79.5	63.5	199.1	550.0	439.4	2,361	217.8	550.0	439.4	1,599
2	77.5	62.1	176.8	550.0	434.9	2,734	184.4	550.0	434.9	1,964
3	75.7	61.1	156.1	550.0	431.8	3,128	162.7	550.0	431.8	2,352
4	74.4	60.2	130.3	550.0	429.1	3,548	136.6	550.0	429.1	2,765
5	73.6	60.9	115.9	550.0	431.2	3,982	121.1	550.0	431.2	3,194
6	73.4	61.6	103.6	550.0	433.3	4,428	108.3	550.0	433.3	3,636
7	73.9	62.1	137.0	550.0	434.9	4,841	101.1	550.0	434.9	4,085
8	75.4	61.8	189.5	0.0	0.0	4,652	114.0	0.0	0.0	3,971
9	77.9	62.6	303.9	0.0	0.0	4,348	175.3	0.0	0.0	3,795
10	80.9	63.8	367.0	0.0	0.0	3,981	216.2	0.0	0.0	3,579
11	84.3	64.4	429.8	0.0	0.0	3,551	265.8	0.0	0.0	3,313
12	87.6	65.8	476.3	0.0	0.0	3,075	305.3	0.0	0.0	3,008
13	90.7	66.9	504.4	0.0	0.0	2,571	297.0	0.0	0.0	2,711
14	93.1	67.6	525.9	0.0	0.0	2,045	310.2	0.0	0.0	2,401

15	94.6	68.3	539.6	0.0	0.0	1,505	319.7	0.0	0.0	2,081
16	95.1	68.6	552.9	0.0	0.0	952	327.5	0.0	0.0	1,753
17	94.9	68.4	514.1	0.0	0.0	438	341.9	0.0	0.0	1,412

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COLD THERMAL STORAGE - ALTERNATIVE 2

	Typical		Weekday				Saturday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
18	94.1	67.9	476.6	38.6	34.0	0	343.8	0.0	0.0	1,068
19	92.8	67.8	457.8	550.0	454.2	92	345.7	550.0	454.2	1,272
20	91.0	66.7	382.9	550.0	450.3	259	326.9	550.0	450.3	1,495
21	89.0	66.7	344.1	550.0	450.3	465	303.4	550.0	450.3	1,742
22	86.7	66.5	313.0	550.0	449.6	702	282.7	550.0	449.6	2,009
23	84.3	66.1	282.7	550.0	448.2	970	261.0	550.0	448.2	2,298
24	81.8	65.0	253.2	550.0	444.4	1,266	228.8	550.0	444.4	2,619

	Typical		Sunday				Monday			
Hour	OADB (F)	OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	79.5	63.5	203.8	550.0	439.4	2,966	211.6	550.0	439.4	4,595
2	77.5	62.1	176.4	550.0	434.9	3,339	180.0	550.0	434.9	4,965
3	75.7	61.1	153.4	550.0	431.8	3,736	153.2	550.0	431.8	5,362
4	74.4	60.2	136.7	550.0	429.1	4,149	132.7	550.0	429.1	5,779
5	73.6	60.9	121.2	550.0	431.2	4,578	117.2	338.3	257.3	6,000
6	73.4	61.6	108.4	550.0	433.3	5,019	104.5	104.5	67.3	6,000
7	73.9	62.1	101.1	550.0	434.9	5,468	138.1	138.1	91.8	6,000
8	75.4	61.8	114.0	0.0	0.0	5,354	190.9	0.0	0.0	5,809
9	77.9	62.6	138.1	0.0	0.0	5,216	305.1	0.0	0.0	5,504
10	80.9	63.8	170.2	0.0	0.0	5,046	367.8	0.0	0.0	5,136
11	84.3	64.4	211.1	0.0	0.0	4,835	430.7	0.0	0.0	4,706
12	87.6	65.8	241.8	0.0	0.0	4,593	476.7	0.0	0.0	4,229
13	90.7	66.9	270.9	0.0	0.0	4,322	504.7	0.0	0.0	3,724
14	93.1	67.6	293.0	0.0	0.0	4,029	526.2	0.0	0.0	3,198
15	94.6	68.3	311.1	0.0	0.0	3,718	539.8	0.0	0.0	2,658
16	95.1	68.6	327.5	0.0	0.0	3,391	552.9	0.0	0.0	2,105
17	94.9	68.4	341.9	0.0	0.0	3,049	514.2	0.0	0.0	1,591
18	94.1	67.9	343.8	0.0	0.0	2,705	476.6	0.0	0.0	1,114
19	92.8	67.8	345.6	550.0	454.2	2,909	457.8	550.0	454.2	1,207
20	91.0	66.7	326.9	550.0	450.3	3,132	382.9	550.0	450.3	1,374
21	89.0	66.7	303.4	550.0	450.3	3,379	344.1	550.0	450.3	1,580
22	86.7	66.5	282.7	550.0	449.6	3,646	313.0	550.0	449.6	1,817
23	84.3	66.1	260.9	550.0	448.2	3,935	282.7	550.0	448.2	2,084
24	81.8	65.0	228.8	550.0	444.4	4,256	253.2	550.0	444.4	2,381

Thermal Energy Storage Systems

a comprehensive one-day seminar on the technologies

PSI Energy
1000 East Main Street
Plainfield, Indiana 46168

Sponsored by

EPRI
Electric Power Research Institute

and

TSARC
Thermal Storage Applications Research Center
University of Wisconsin - Madison

Notes

Theoretical Storage Volume Requirements

Presently, these are three different types of media for storing thermal energy in a cool storage system: ice, salt hydrates and water. The first two undergo a change of phase while storing or releasing heat energy. The third, water, does not.

Each storage media requires some inherent volume and mass for storing heat energy. If one could neglect circulation space and assume 100% storage utilization, the theoretical storage volumes would be:

ice: 1.46 ft^3/ton-hour

salt hydrate: 3.18 ft^3/ton-hour

water: 9.62 ft^3/ton-hour

The figures shown for ice and salt storage are based upon latent heat capacity only. The figure for water is based upon a 20° change in storage temperature, from 40° to 60°.

These storage volumes are theoretical only. They are not obtainable in the field for several reasons. First, it is necessary to allocate some of the storage volume for internal circulation of fluid for heat transfer. While some manufacturers would like to have us believe otherwise, no thermal storage system is 100% efficient. Not all internal energy is completely usable. These factors result in actual storage volumes considerably above these figures. For example, these have become commonly accepted:

ice:	2.25 to 3.00 ft^3/ton-hour
salt hydrate:	5.50 to 6.00 ft^3/ton-hour
water:	12.50 to 13.00 ft^3/ton-hour

The lower value for ice storage represents a typical value for an encapsulated ice storage vessel; the higher value is for an ice harvester system.

Storage volumes often do not represent the actual storage "floor space" required. Many manufacturers build their systems in round or cylindrical tanks. In these cases, the required floor space is something above the "footprint" of a storage vessel, depending upon whether it is oriented in a horizontal or vertical configuration. Some amount of space is needed for access, however this often is quite minimal since very little if any servicing to the storage itself is ever needed. Some manufacturers' systems can be directly buried if the vessels are built to accommodate this.

Notes

were installed vertically, the space requirement would be about 0.063 ft^2/ton-hour. This is usually, as mentioned before, not possible unless the tank is outdoors. If installed horizontally, the storage vessel space requirement becomes 0.237 ft^2/ton-hour.

A normal required area range for vertical tanks is 0.063^2/ton-hour for a 45 ft high tank to 0.12^2 for a 25 high tank. Horizontal tanks will need an area of approximately 0.235 to 0.238 ft^2/ton hour.

Chilled Water Storage Systems

Chilled water storage systems are really nothing more than a tank of cold water held as close to 40° as possible. Why 40°? Because at this temperature, water is at its greatest density (this actually occurs at 39.2°, but 40° has become the standard minimum design temperature).

Many chilled water storage systems have been built. Extensive research has been done, and some very fine publications have come out of this effort, most notably that from EPRI. EPRI's publication EM 4852, Stratified Chilled Water Storage Design Guide is probably the most authoritative of all publications thus far. Research has proven that of all storage methods, a single stratified storage tank has the greatest reliability and at the lowest cost.

Notes

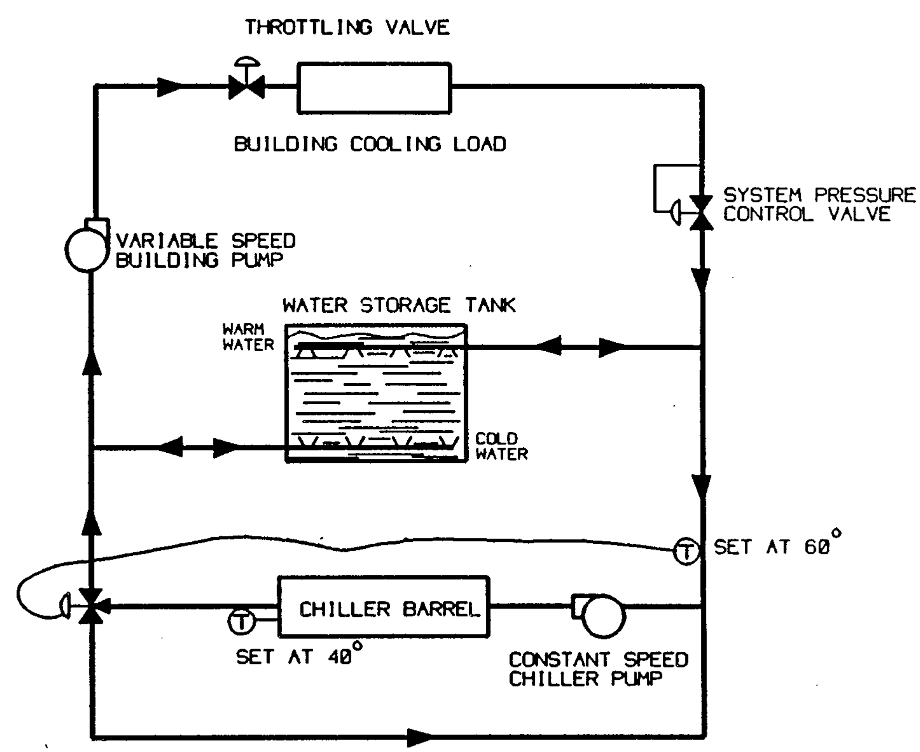
There is one important consideration about stratified water systems that one must keep in mind. Water returning from the building air-handling unit (cooling coil) MUST always return at a constant temperature (or very close to it). One may deduce from this statement that water flow rates are not constant, but variable. Hence this system would imply variable speed pumping. The only exception to this is the water flow circuit through the chiller itself, which is constant flow. Flow to the building is variable as is flow to the storage tank. Three-way valves on cooling coils cannot be used. If retrofitting an existing system, and it has three way valves, simply close off the bypass ports and cap them.

When retrofitting an existing air handling unit, check to see that it has a chilled water coil of at least 6 rows of tubing with 14 fins per inch. Eight rows are highly recommended. If the coil bank has less than 6 rows, add an additional cooling coil piped in series with the existing coil. If this is not possible, use another cool storage technology.

Manufacturers of stratified chilled water tanks are:

- CBI (Chicago Bridge & Iron Company - Stratatherm Div.)
- General Engineering Corp.
- Van Doren Industries

Notes



Space Requirements

The optimum storage tank for a stratified chilled water system is a round tank, no less than 12 feet deep. Depths greater than 12 ft are possible, but add little to the overall tank utilization efficiency. Because insulation of a water storage tank is so important, it is wise to design the tank so that total surface area is minimized while holding the minimum tank depth to 12 feet as mentioned before.

Based upon 6" of insulation on top and sides, a 12 ft depth and a 90% tank utilization, the required surface area will range between 1.043 ft^2 to 1.05 ft^2 per ton-hour. This area is for a rectangular tank.

Salt Hydrate Systems

This concept is quite similar to the encapsulated ice technology, except a higher temperature phase-change material (PCM) is used. (Note the used of the term "phase change material" - any substance that undergoes a change in its phase during the heat transfer process is a phase change material. For example, water meets this definition, when its goes from its liquid to solid phases. In so doing, its absorbs 144 btu/lb in the process.)

In a salt hydrate system, a proprietary salt mixture is used. Two types of salts, each having difference phase-change temperatures, can be selected as the storage medium. One freezes at 47°, the other at 41°.

Notes

T e 1

Demand & Energy of Thermal Storage Technologies(1)

	TO STORAGE				TO LOAD			
	PEAK DAY, kW/TON		SEASONAL, kWh/TON-HR		PEAK DAY, kW/TON		SEASONAL, kWh/TON-HR	
TECHNOLOGY	LO	HI	LO	HI	LO	HI	LO	HI
CHILLED WATER STORAGE(3)	1.00	1.10	0.75	0.95	0.95	1.05	0.65	0.95
SALT HYDRATE(3)	0.85	1.10	0.65	0.95	0.95	1.05	0.65	0.95
ICE HARVESTER(2)	0.95	1.50	0.80	1.10	0.75	0.95	0.50	0.95
B&R ICE(3)(5)	1.00	1.60	0.95	1.25	0.95	1.05	0.65	0.80

(1) All figures include allowances for condenser or cooling tower fans, condenser and chilled water pump(s). "LO" figures are for evaporative-cooled equipment; "HI" figures are for water-cooled equipment. If air-cooled equipment is used, multiply ranges shown by 1.35.

(2) "LO" figures are for systems with refrigerant liquid overfeed, hi-side drainers and screw compressors with floating head pressure - see text.

(3) Water-cooled chillers, either reciprocating, screw or centrifugal, with constant condenser water inlet temperatures will exhibit values 1.5 to 2.5 times figures shown.

(4) On-peak demand for load shifting systems will range between 0.03 to 0.05 kW/ton for operation of chilled water pump(s).

(5) B&R Ice = Brine & Refrigerant Ice

Costs of Thermal Storage Systems

Notes

CONCEPT	$/TON-HOUR
chilled water	$60 - $85 (An average of $75.00 is used.)
harvester	$125 - $145
salt hydrate	$100 - $120
brine/refg ice	$65 - $100

With the exception of the ice harvester, the balance of these concepts do not include cost for a refrigeration plant. The harvester does. The harvester system is a completely packaged unit and includes a storage tank.

All costs assume an "easy" installation, the storage system located immediately adjacent an outside equipment room wall.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: TECH AREA CHILLER PLANT (ALT 3) FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 11/11/92 ECONOMIC LIFE: 25 PREPARED BY: T. FORSTER

1 INVESTMENT

A.	CONSTRUCTION COST	=	$4,813,733	
B.	SIOH COST	(5.5% of 1A) =	$264,755	
C.	DESIGN COST	(6.0% of 1A) =	$288,824	
D.	ENERGY CREDIT	(1A + 1B + 1C) =	$5,367,312	
E.	SALVAGE VALUE	=	$0	
F.	TOTAL INVESTMENT	(1D – 1E) =	————>	$5,367,312

2 ENERGY SAVINGS (+) / COST (–)

	FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	$6.48	6,146	$39,796	15.23	$606,091	
B.	DIST		0	$0	17.28	$0	
C.	NAT GAS	$2.21	(57,062)	($126,244)	19.64	($2,479,432)	
D.	PAPER		0	$0		$0	
E.	COAL			$0	16.22	$0	
F.	TOTAL		(50,916)	(86,448.1)		————>	($1,873,341)

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS + MAINTENANCE COST SAVINGS) = $84,043

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $1,233,751

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$100,000	1	0.96	$96,000
b. EQUIP REPLACEMENT COST	$193,500	5	0.80	$154,800
c. EQUIP REPLACEMENT COST	$713,250	10	0.64	$456,480
d TOTAL	$1,006,750			$707,280

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $1,941,031

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = ($618,202)

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = -0.46

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$37,865
5	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$67,690
6	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.01
7	SIMPLE PAYBACK (SPB) YRS	(1F/4) =	142

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR
EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed)
TECH AREA (ALT 3)

PROPOSED TOTAL CONTRACT PRICE

PURCHASE REQUEST NUMBER

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST Unit (4)	MATERIAL COST Total (5)	LABOR COSTS Manhours Mandays (6)	LABOR COSTS Average Rate (7)	LABOR COSTS Total (8)	Other Direct Costs (9)	Line Total (10)
1	200 TON CENT. CHILLER W/ STEAM TURBINE 400 TON CENT. CHILLER W/ STEAM TURBINE	LUMP SUM		280000	280000					$280,000
2	2100 TON COOLING TOWER WITH SURFACE CONDENSER	LUMP SUM								$0
3	PUMPS, VALVES, ETC.	LUMP SUM		170000	170000					$170,000
4	2000 SQ.FT. BLDG.	SF	2000	30.00	60000					$60,000
5	BURIED CWS & CWR PIPING	LUMP SUM		558700	558700					$558,700
6	VAULT W/EXP. JOINTS, VALVES, ENCHORS, ETC	EA	5	10800	54000					$54,000
7	INTERCONNECTION @ BLDG.	EA	9	14000	126000					$126,000
8	GAS TURBINE WITH 875 kW GENERATOR HRSG AND AUX BOILER	EA	1	672400	672400					$672,400
9	GAS BOOSTER COMPRESSOR	EA	1	75000	75000					$75,000
10	CONNECTION TO BASE ELECTRICAL SYSTEM ELECTRIC SWITCH GEAR	EA	1	125000	125000					$125,000
11	STEAM AND CONDENSATE PIPING SYSTEM	EA	1	1170828	1170828					$1,170,828
12	BUILDING HEATING SYSTEM CONVERVSIONS	EA	1	273830	273830					$273,830
	SUBTOTAL									$3,565,758
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									$891,440 $356,576
	TOTAL THIS SHEET									$4,813,773

D23-2

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: TECH AREA CHILLER PLANT (ALT 3)   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 11/11/92   ECONOMIC LIFE: 25   PREPARED BY: T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST	=	$4,364,493	
B. SIOH COST	(5.5% of 1A) =	$240,047	
C. DESIGN COST	(6.0% of 1A) =	$261,870	
D. ENERGY CREDIT	(1A + 1B + 1C) =	$4,866,410	
E. SALVAGE VALUE	=	$0	
F. TOTAL INVESTMENT	(1D – 1E) =	————>	$4,866,410

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	2,845	$18,420	15.23	$280,543	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	(50,716)	($112,204)	19.64	($2,203,688)	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		(47,871)	(93,783.7)		————>	($1,923,145)

3 NON–ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS + MAINTENANCE COST SAVINGS) = $22,033

1 DISCOUNT FACTOR (From Table A–2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $323,444

B. NON–RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$100,000	1	0.96	$96,000
b. EQUIP REPLACEMENT COST	$193,500	5	0.80	$154,800
c. EQUIP REPLACEMENT COST	$713,250	10	0.64	$456,480
d TOTAL	$1,006,750			$707,280

C. TOTAL NON–ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $1,030,724

D. PROJECT NON–ENERGY TEST

1 25% MAXIMUM NON–ENERGY CALCULATION (2F5 x 0.33) = ($634,638)

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = –0.53

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	($31,481)
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	($892,421)
6 DISCOUNTED SAVINGS–TO–INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	–0.18
7 SIMPLE PAYBACK (SPB)	(1F/4) =	–155

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR
EMC ENGINEERS INC.

ADDRESS
2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed)
TECH AREA (ALT 3)

PROPOSED TOTAL CONTRACT PRICE

PURCHASE REQUEST NUMBER

PROJECT NUMBER

WORK LOCATION
WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	MATERIAL COST		LABOR COSTS			Other Direct Costs (9)	Line Total (10)
				Unit (4)	Total (5)	Manhours Mandays (6)	Average Rate (7)	Total (8)		
1	200 TON CENT. CHILLER W/ STEAM TURBINE 400 TON CENT. CHILLER W/ STEAM TURBINE	LUMP SUM	1	280000	280000					$280,000
2	2100 TON COOLING TOWER WITH SURFACE CONDENSER	LUMP SUM	1							$0
3	PUMPS, VALVES, ETC.	LUMP SUM	1	170000	170000					$170,000
4	1600 SQ.FT. BLDG.	SF	1600	30.00	48000					$48,000
5	BURIED CWS & CWR PIPING	LUMP SUM	1	558700	558700					$558,700
6	VAULT W/EXP. JOINTS, VALVES, ANCHORS, ETC	EA	5	10800	54000					$54,000
7	INTERCONNECTION @ BLDG.	EA	9	14000	126000					$126,000
8	GAS TURBINE WITH 500 KW GENERATOR HRSG AND AUX BOILER	EA	1	406600	406600					$406,600
9	GAS BOOSTER COMPRESSOR	EA	1	50000	50000					$50,000
10	CONNECTION TO BASE ELECTRICAL SYSTEM ELECTRIC SWITCH GEAR	EA	1	95000	95000					$95,000
11	STEAM AND CONDENSATE PIPING SYSTEM	EA	1	1170828	1170828					$1,170,828
12	BUILDING HEATING SYSTEM CONVERVSIONS	EA	1	273830	273830					$273,830
	SUBTOTAL									$3,232,958
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									$808,240 $323,296
	TOTAL THIS SHEET									$4,364,493

D23-4

E M C ENGINEERS, INC.

Denver • Atlanta • Germany

TECH AREA
ALT. # 3

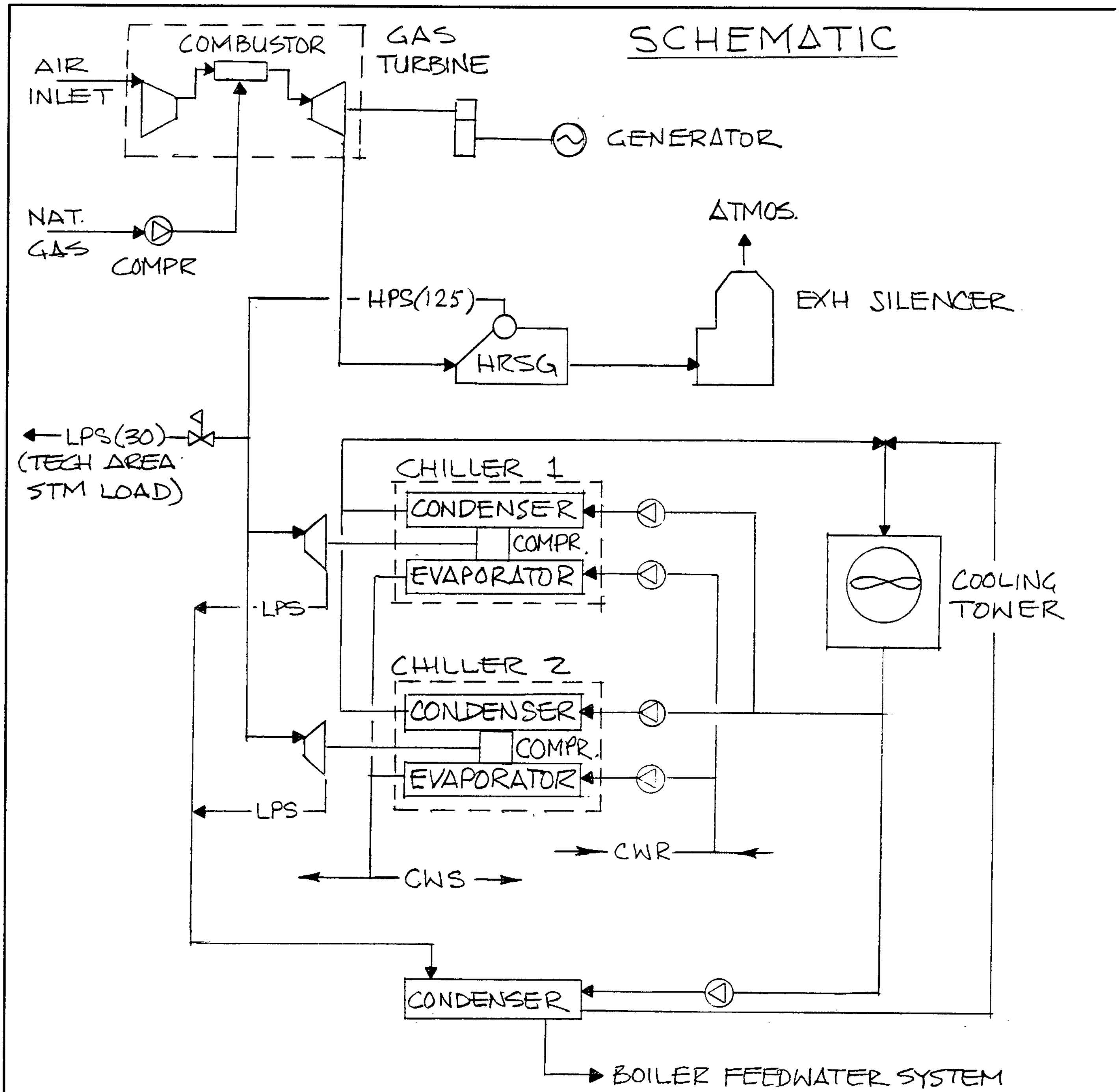
JOB WSMR ESOS STUDY 1110.000

SHEET NO. 1 OF 1

CALCULATED BY C. Butler DATE 11/10/92

CHECKED BY TF DATE 11/12/92

SCALE



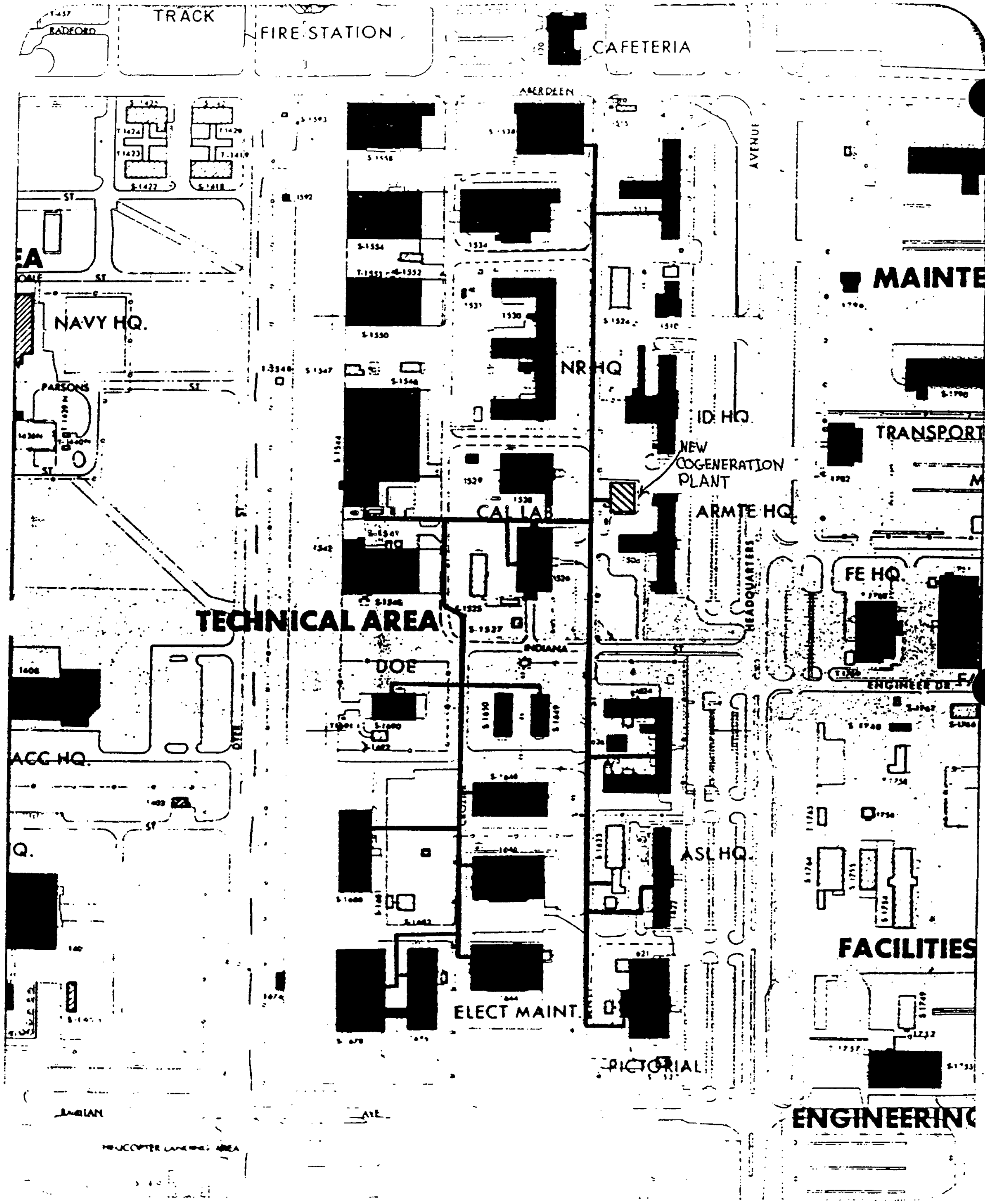


FIG. 8-6
STEAM DISTRIBUTION PIPING

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

JOB

SHEET NO. OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

ALT # 3

COST ESTIMATE WORKSHEET

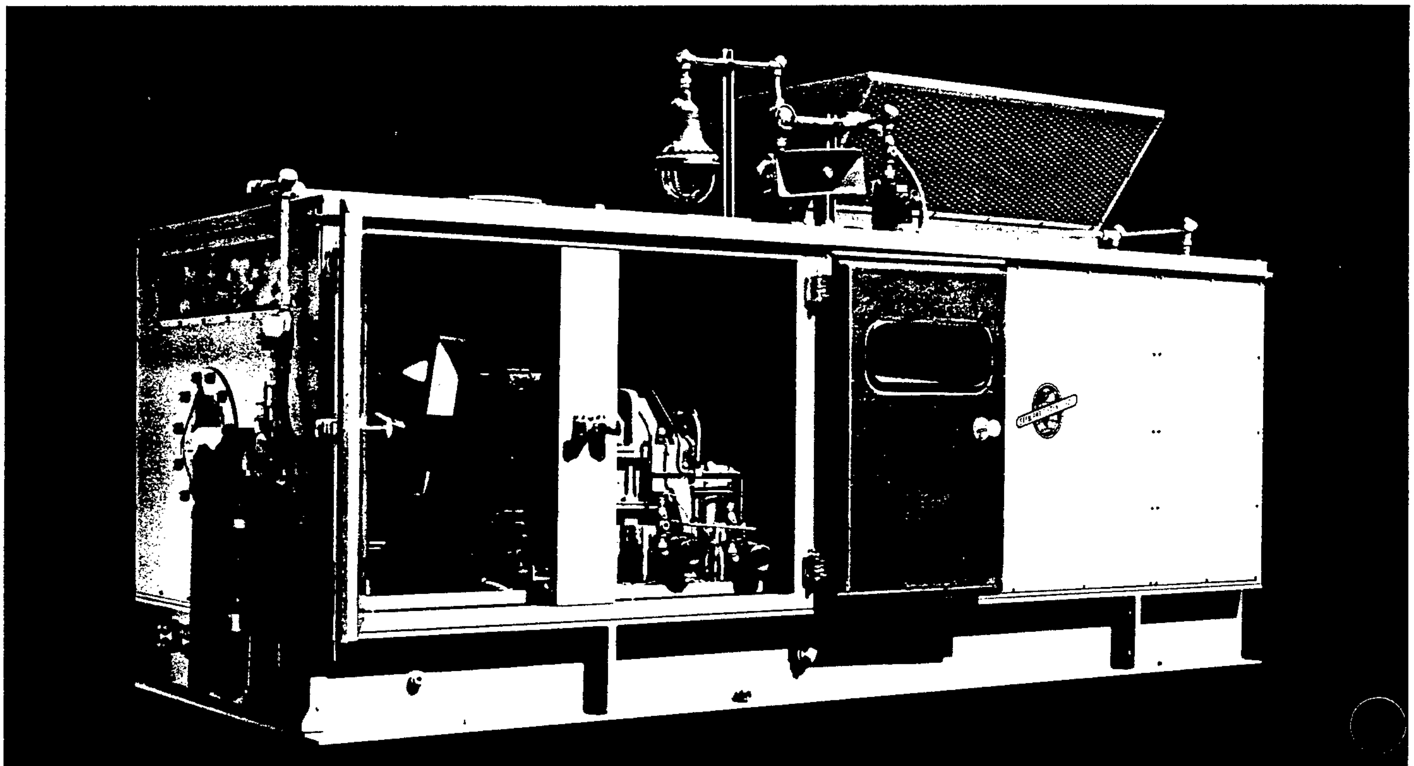
	MAT'L	LABOR	TOTAL
GARRETT 831 500 KW GAS TURB/GEN SET: w/ FUEL COMPRESSOR	$325,000	$8,000	$333,000
875 KW GAS TURB/GEN SET: (ESTIMATED)	$550,000	$15,000	$565,000
200 TON ROT. SCREW COMP CHILLER W/STM TURBINE; 400 TON R.S.C. W/ STM TURBINE	$270,000	$10,000	$280,000
2100 TON COOLING TOWER	$44,000	$4,400	$48,400
PUMPS, VALVES, ETC.	$127,500	$42,500	$170,000
HRSG. (4000 LB/HR)	$23,000	$5,600	$28,600
HRSG. (7100 LB/HR)	$56,800	$12,000	$68,800
BOILER (12.8 MBtu/Hr)	$39,000	$6,000	$45,000
BOILER (9.1 MBtu/Hr)	$34,000	$4,600	$38,600
SURFACE CONDENSER (16.4 MBTU/HR)	$70,000	$6,000	$76,000
EVAP COOLER FOR G.T. INLET	$17,500	$7,500	$25,000

GAS TURBINE PRODUCTS

BY

STEWART & STEVENSON SERVICES

MODEL GT-500
GAS TURBINE
GENERATOR SET



TYPICAL GAS TURBINE GENERATOR SET WITH OPTIONAL ENCLOSURE

Specifications

ENGINE

Manufacturer	Garrett Corporation
Type	Single Shaft Gas Turbine
Engine Rotor Speed	41,730 RPM
Main Output Speed	1500/1800 RPM
Compressor Type	Two stage, Centrifugal
Compression Ratio	11:1
Turbine Type	Three stage, Axial
Combustor Type	Single can
Rating:	
*Stand-by	800 HP (597 KW)
*Continuous	735 HP (548 KW)
Airflow: At Continuous Rating	
Inlet	6100 CFM (7.76 lbs/sec)
Exhaust	16100 CFM (7.89 lbs/sec)
Exhaust Temp.	925 °F
Unit Weight (dry)	10,000 lb.

GENERATOR

Type	Drip Proof
KW	**515 KW
Power Factor	0.8
Voltage	As required
Phase	3
Frequency	50/60 Hertz
RPM	1500/1800 RPM
Exciter	Brushless

*Ratings are based on plus or minus 5% performance at sea level and 59°F (15°C) conditions without generators and duct losses.

**Continuous rating based on 94% generator efficiency.

STANDARD EQUIPMENT

Garrett IM-831 gas turbine with integral gearbox and couplings

515 KW continuous duty rating brushless type generator 480 V, 3P, 60 Hz

Lube Oil System - Self contained within package except cooler

Lube Oil Cooler: Water-to-oil Shell and Tube type for remote mounting

Skid: I-Beam construction, all customer connections at turbine end

Turbine controls and batteries for location in customer control room

Two Stage air inlet filter

Air Inlet silencer

Turbine exhaust expansion joint

Natural Gas Fuel System: 200-210 PSIG required

24 VDC Electrical Starting System

Full load unit performance test (with contract switchgear if desired)

Enclosure: Indoor and outdoor installation w/sound attenuation

OPTIONAL EQUIPMENT (Partial List)

Pneumatic Starting System: Air or Natural Gas 50-150 PSIG Required, 1500 SCFM/Start

Exhaust Silencer

Generator set switchgear with paralleling features and circuit breaker.

Fire/Gas extinguishing and detection system

Liquid Fuel System

Diesel #1, Diesel #2, Kerosene, propane

OPTIONAL EQUIPMENT (Continued)

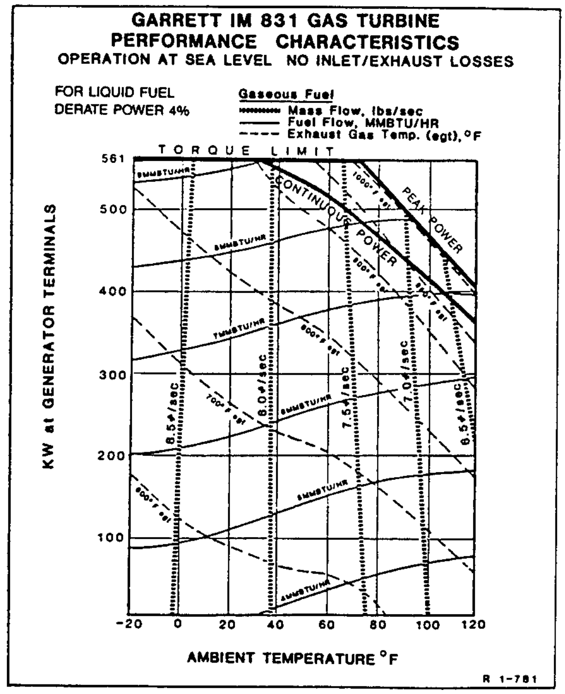
Dual Fuel System: Liquid/natural gas; auto switchover without loss of power during normal operation in the event that primary source of fuel is lost.

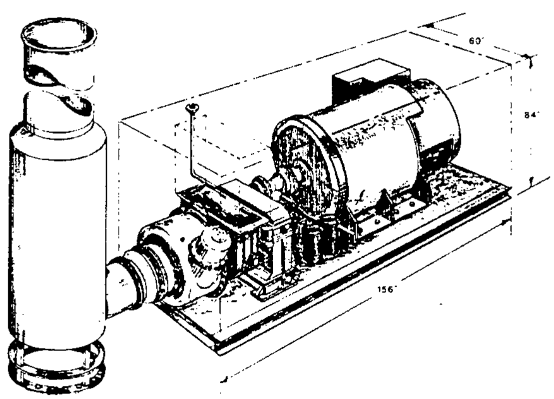
Waste Heat Recovery Systems:

Steam Production

Refrigeration

Desalination





TYPICAL GARRETT 831 GAS TURBINE GENERATOR SET

Specifications and information contained in this brochure subject to change without notice.

STEWART & STEVENSON SERVICES, INC.
World Headquarters: 2707 N. Loop West
Mailing Address: P.O. Box 1637
Houston, Texas 77251-1637, (713) 868-7700

Offices: Amarillo, Beaumont, Corpus Christi, Dallas, Harlingen, Houston, Lubbock, Odessa, San Antonio, Wichita Falls, TX; New Orleans, LA; Denver, CO; Albuquerque, Farmington, NM; Casper, WY; Arlington, VA; San Francisco, CA; Caracas; Maracaibo; Hong Kong; Al Khobar, Saudia Arabia.

SS-GT-03 (1/89)

FAMOUS FOR SERVICE AROUND THE WORLD

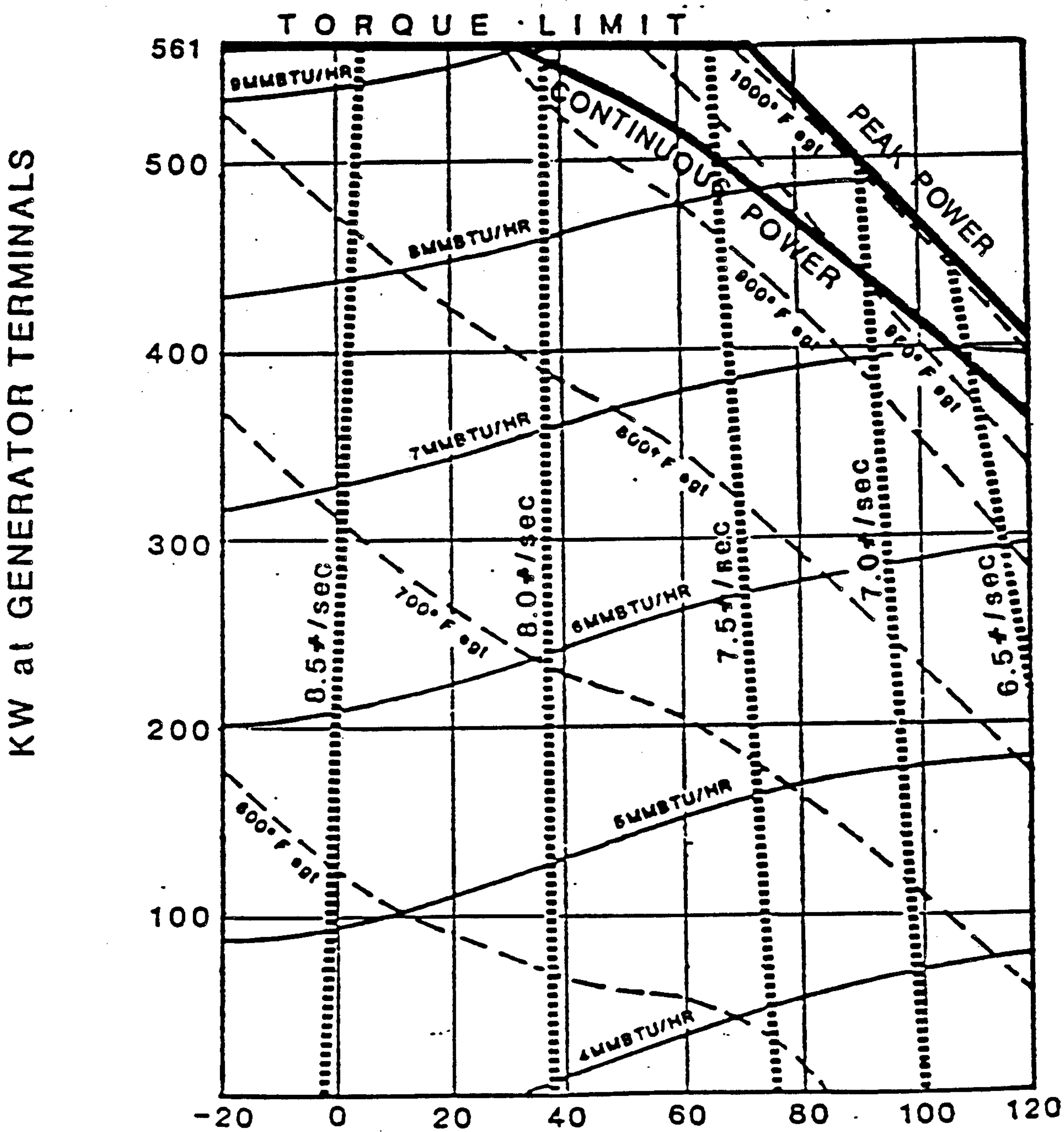
STEWART & STEVENSON

GARRETT IM 831 GAS TURBINE PERFORMANCE CHARACTERISTICS

OPERATION AT SEA LEVEL NO INLET/EXHAUST LOSSES

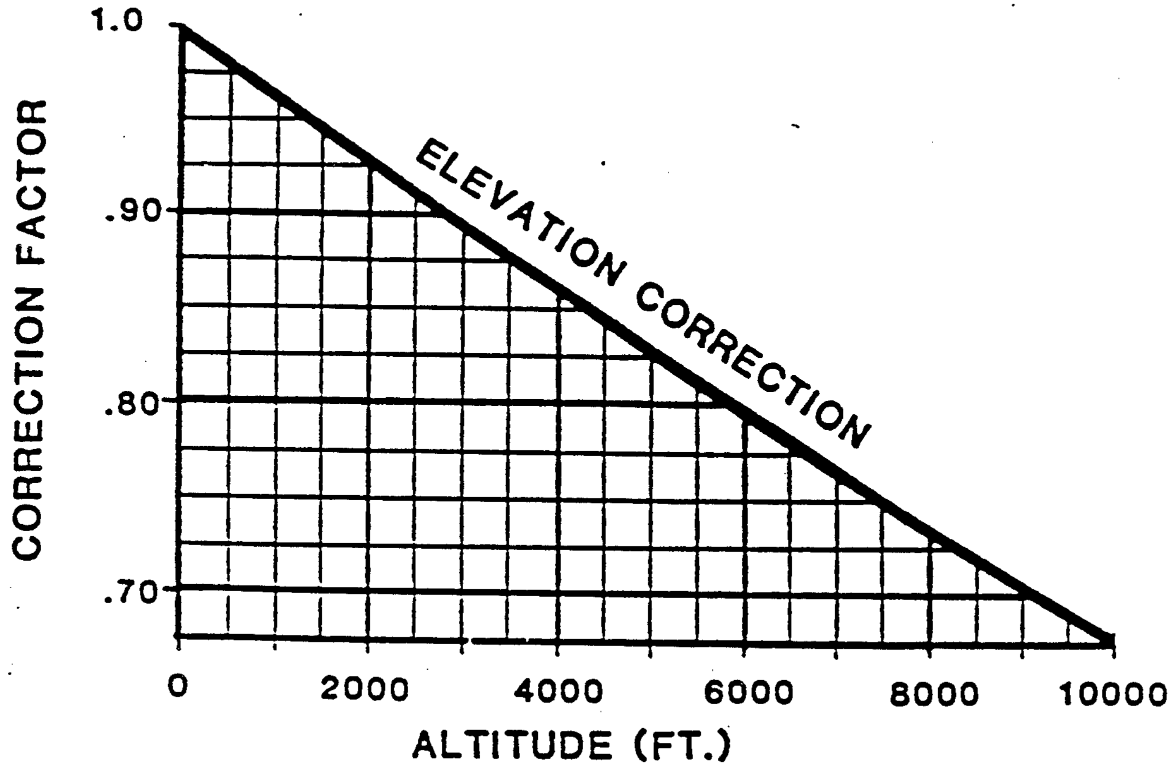
FOR LIQUID FUEL
DERATE POWER 4%

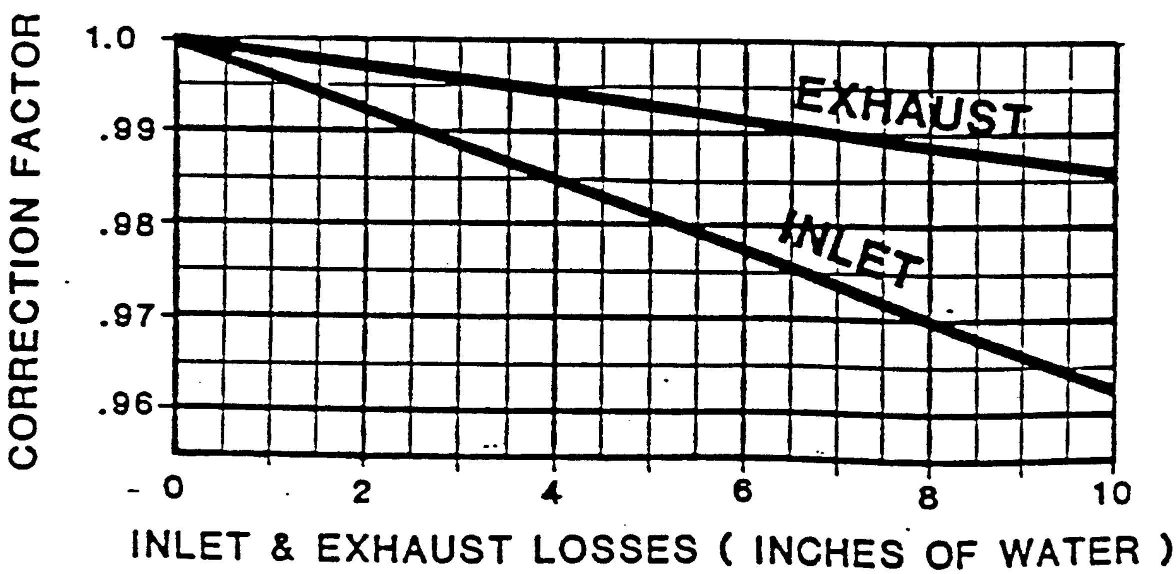
Gaseous Fuel
Mass Flow, lbs/sec
Fuel Flow, MMBTU/HR
Exhaust Gas Temp. (egt), °F



R2 040488

POWER CORRECTION FACTORS FOR GAS TURBINE APPLICATION





FRY EQUIPMENT CO., INC.

2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442

FAX: (303) 922-8445

DATE: 4 NOV 92

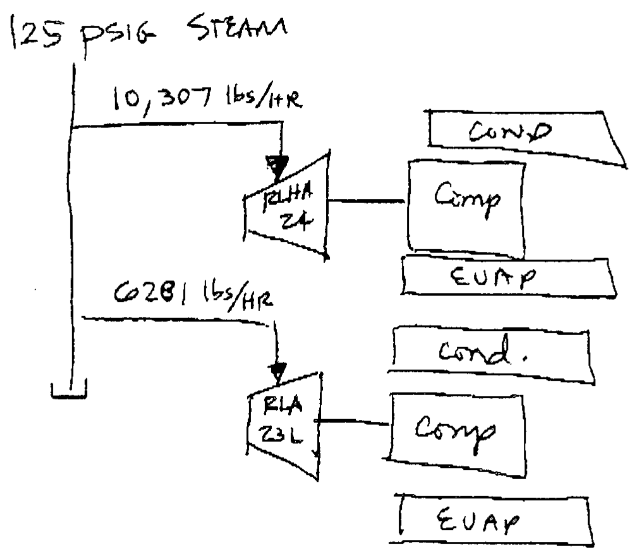
TRANSMITTED TO: EMC

ATTENTION: TOM FORSTER **FROM:** LOU GROUNDS

SUBJECT: SELECTION ON STEAM TURBINES @ 125 → 0°

This Transmission Consists of 5 Pages Including This Page.

TOM:



400 TONS, DUNHAM-BUSH
X.8 HP/TON
≅ 320 BHP
#IPCX-40

200 TONS, DUNHAM-BUSH
X.8 HP/TON
≅ 160 BHP
IPCX-230

QTY
1 - COPPUS RLA-23L TURBINE, 160 HP
$ BUDGET $18,000

QTY
1 - COPPUS RLHA-24 TURBINE, 320 HP
$ BUDGET $28,500

COPPUS STEAM TURBINE SELECTION

White Sands
Alamogordo, N.M.

Attn: EMC Engineers

Date:	11-06-1992
Customer ref:	Tom Forster, PhD, P.E
User:	
Driven equip:	Steam Drive Chillers
Coppus ref:	Fry Equipment
Agent:	Lou Grounds

TURBINE DATA:

Item no.	
Frame size	RLA 23L

STEAM CONDITIONS:

	Norm	Units
Inlet press.	125	psig
Inlet temp.	360	°F
Exhaust press.	0	psig

PERFORMANCE:

HP	Speed rpm	St.rate lb/hp/hr	Flow lb/hr	Exh.temp °F	HV closed
158	3600	39.8	6281	212	1
104	3600	40.2	4184	212	5
52	3600	41.4	2150	212	9

CONSTRUCTION:

Construction	200	
Inlet size	3	in.
Exhaust size	8	in.
Shaft size	2.125	in.
Hand valves	9	

LIMITS:

Potential Max. Power: 214 HP

COMMENTS:

Ver.1.0,1987

COPPUS STEAM TURBINE SELECTION

White Sands		Date:	11-06-1992
Almagordo, N.M.		Customer ref:	Tom Forster, PhD, P.E
		User:	
		Driven equip:	Steam Drive Chillers
		Coppus ref:	Fry Equipment
Attn: EMC Engineers		Agent:	Lou Grounds

TURBINE DATA:

Item no.		
Frame size	RLHA 24	

STEAM CONDITIONS:

	Norm	Units
Inlet press.	125	psig
Inlet temp.	360	°F
Exhaust press.	0	psig

PERFORMANCE:

HP	Speed rpm	St.rate lb/hp/hr	Flow lb/hr	Exh.temp °F	HV closed
320	3600	32.2	10307	212	0
211	3600	33.0	6956	212	2
106	3600	39.5	4189	212	2

CONSTRUCTION:

Construction	200	
Inlet size	4	in.
Exhaust size	10	in.
Shaft size	2.5	in.
Hand valves	2	

LIMITS:

Potential Max. Power: 480 HP

COMMENTS:

<Consult factory for hand valve selection>

Ver.1.0,1987

JOB WSMR ESOS STUDY #1110-000

SHEET NO. ______ OF ______

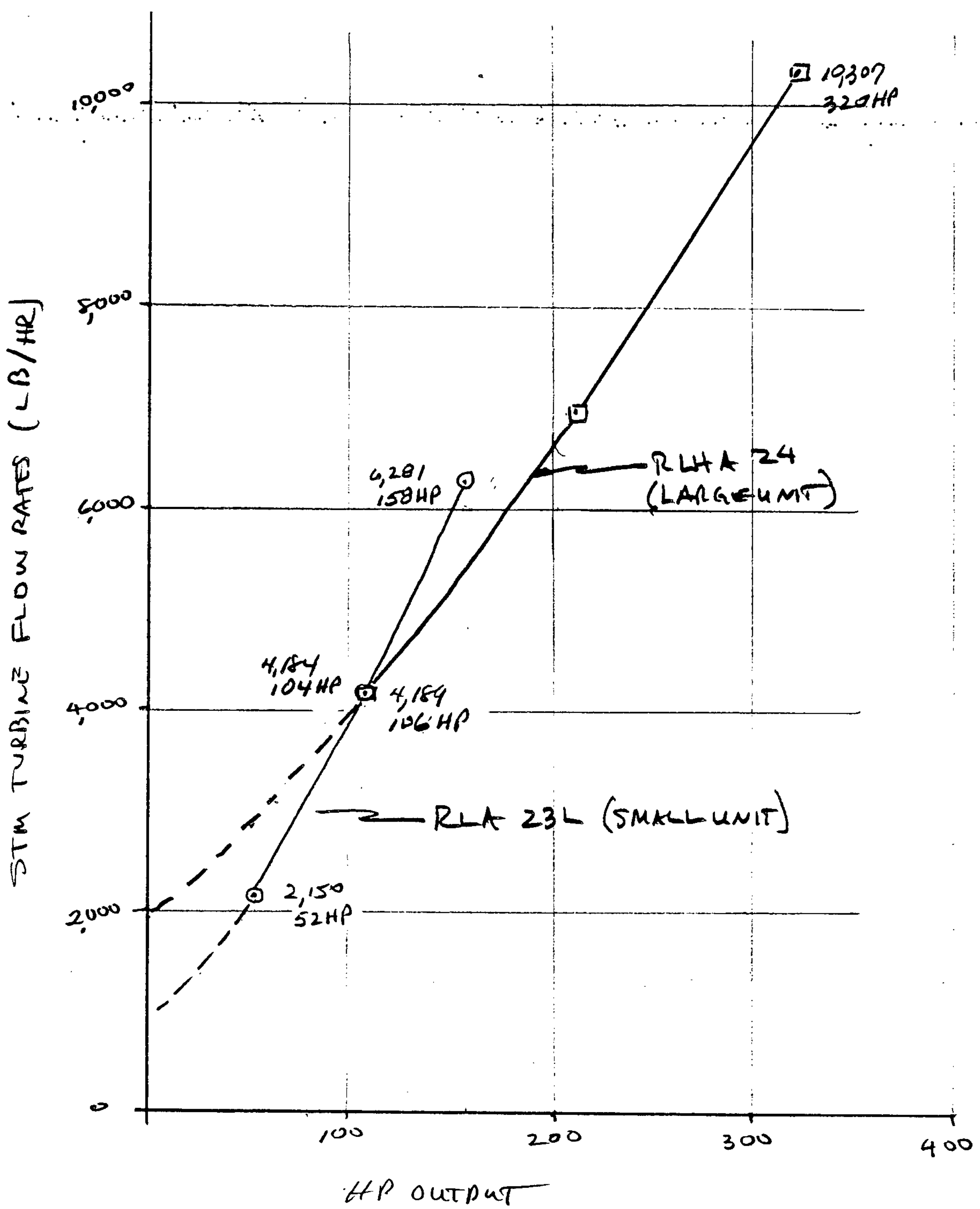
E M C ENGINEERS, INC.

Denver • Atlanta • Germany

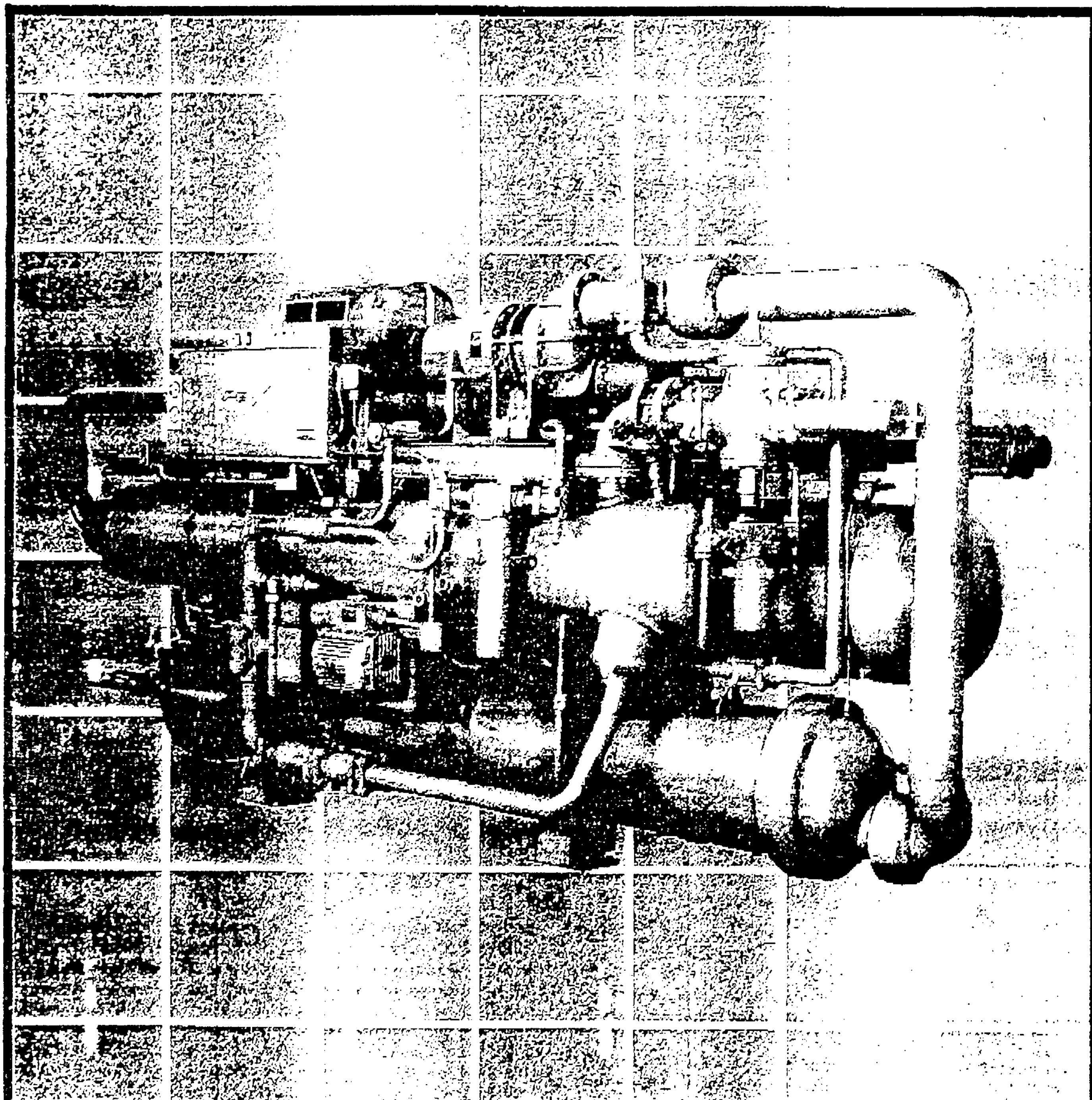
CALCULATED BY TF DATE 11-06-92

CHECKED BY ______ DATE ______

ALT #3 STM TURBINE PERF. CURVE SCALE ______



Industrial Packaged Chillers
IPCX Water—Cooled
120 Thru 750 Tons
R22 Rotary Screw Compressors



DUNHAM-BUSH
INDUSTRIAL REFRIGERATION DIVISION
Products That Perform. By People Who Care.

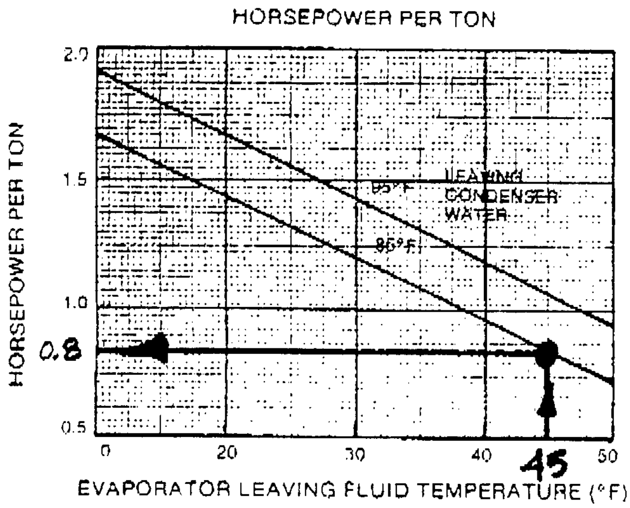
D23-16

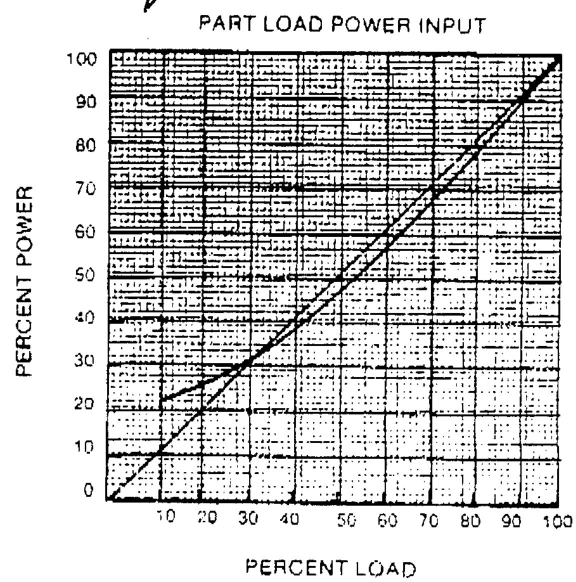
SELECTION PROCEDURE

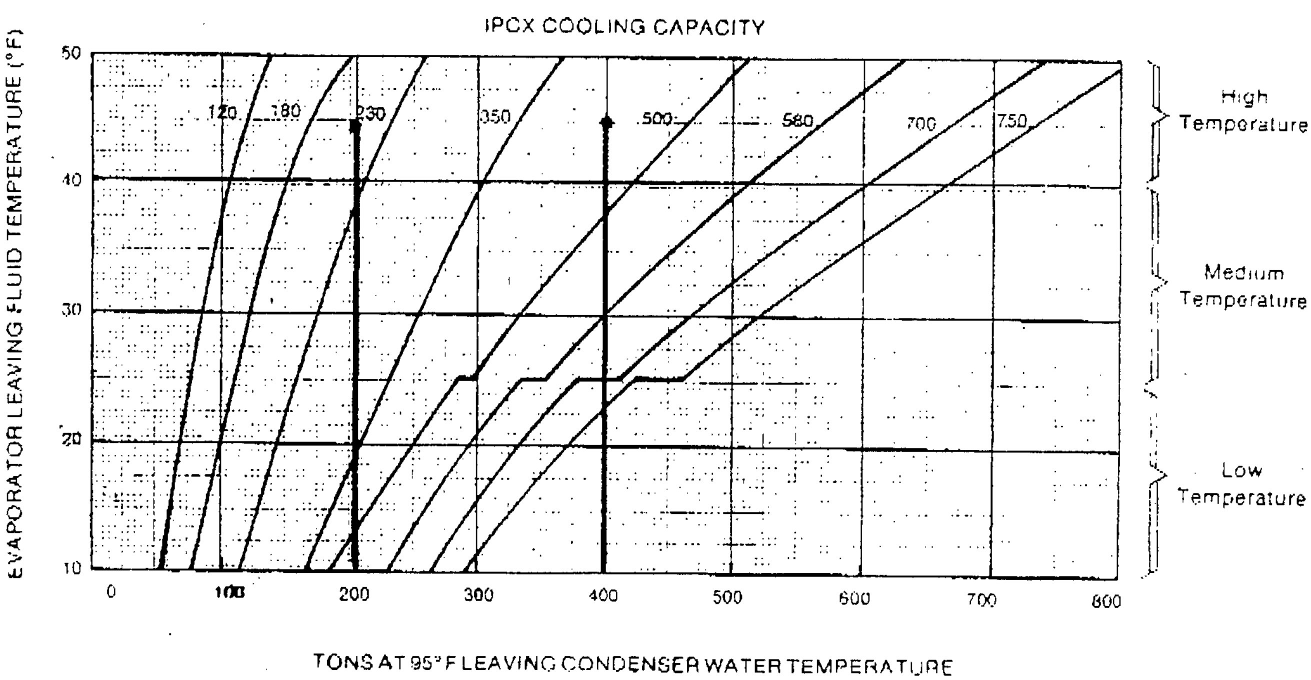
UNIT SELECTION - Selection curves are located below. Unit size is determined by the intersection of the required cooling tons and leaving fluid temperature. Selections are based on an ethylene glycol solution with a freeze point 10° F below the evaporating temperature. Please contact the local Dunham-Bush representative for selections at leaving temperatures below 10° F.

HORSEPOWER PER TON - Compressor horsepower per ton can be estimated from Figure 1 as a function of the cooled fluid leaving temperature and the condenser water leaving temperature. As a rule of thumb, the curve values for horsepower at design conditions can be reduced by 15 percent to estimate annual average electric consumption. This reduction results from operation at lower annual average condenser water temperatures resulting from annual average wet bulb temperatures lower than design.

PART LOAD PERFORMANCE - The curve on this page gives approximate percent power input as a function of the percent of full load tons and applies equally to all size units.







E M C ENGINEERS, INC.
Denver • Atlanta • Germany

JOB WSMR ESOS STUDY #1110-000

SHEET NO. ______ OF ______

CALCULATED BY TF DATE 11-04-92

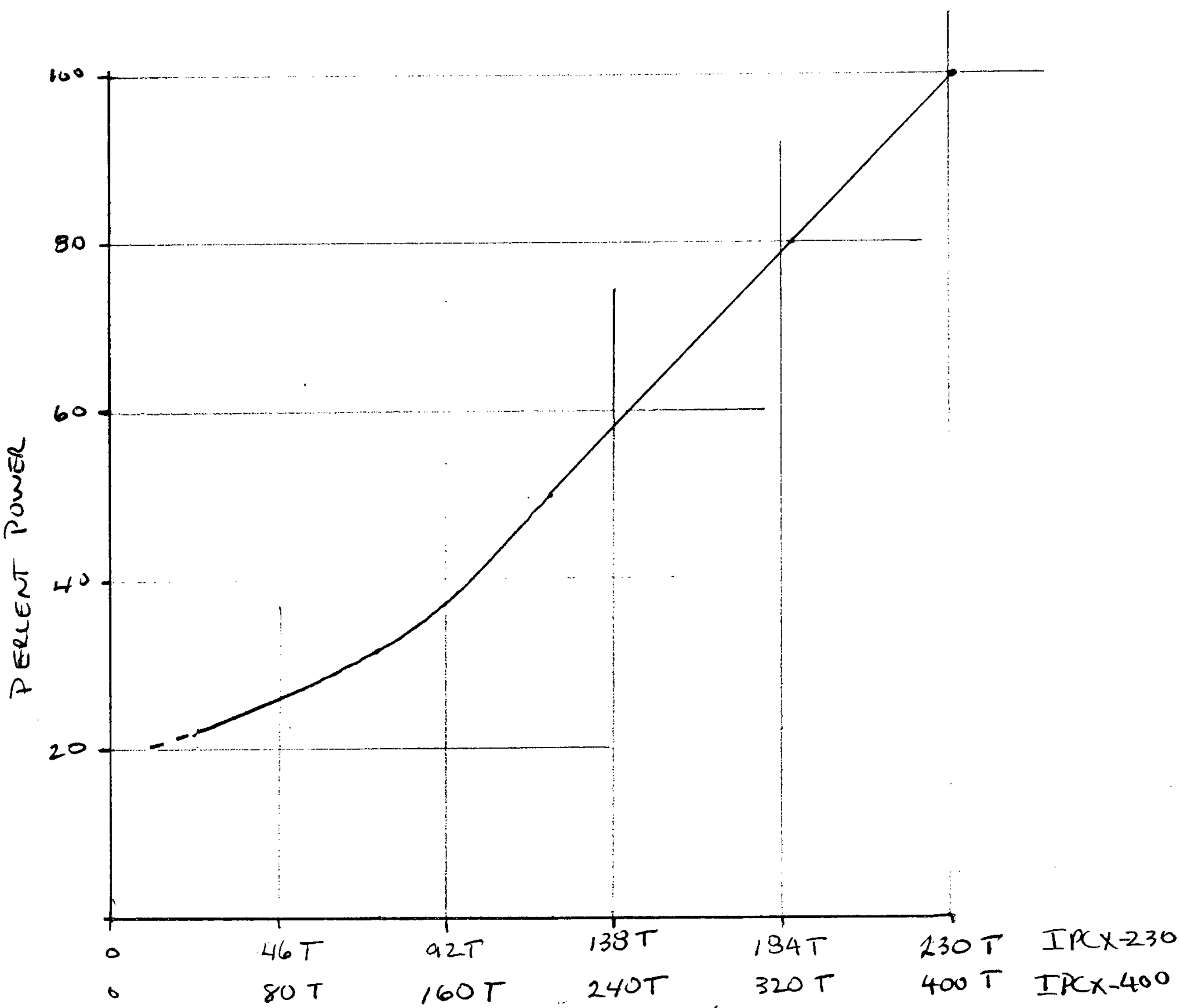
CHECKED BY ______ DATE ______

SCALE ______

ALT #3 ROT. SCREW COMP PERF CURVE

SOURCE: DUNHAM-BUSH (FRY EQUIPMENT CO., DENVER)

#IPCX-400	400TON / 320 HP
#IPCX-230	230TON / 158 HP



JOB WSMR ES05 STUDY #1110-000

SHEET NO. 3 OF

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

CALCULATED BY TF DATE 11-04-92

CHECKED BY DATE

SCALE

TECH AREA ALT #3

SURFACE CONDENSER SIZING.

REJECTED HEAT CALCULATION: 0# STEAM MUST BE CONDENSED (980 BTU/LB).

PLANT COOLING LOAD (TONS)	STEAM FLOW RATE (LB/HR)	HEAT OF CONDENSATION (MBtu/hr.) / (TONS)	
100	5,970	5.85 / 487.5	
200	6,281	6.16 / 513.3	
300	11,245	11.02 / 918.3	
400	10,307	10.10 / 841.7	
500	17,767	17.41 / 1451.8	← MAX HEAT REJECTION.
600	16,588	16.26 / 1355.0	

$\boxed{\text{SIZE SURFACE CONDENSER AT 16.26 MBTU/HR}}$

SIZE COOLING TOWER:

HEAT OF REJECTION FROM CHILLERS = 600 TONS $\times \left(1 + \frac{1}{COP}\right)$

= 600 X 1.2 = 720 TONS

SURFACE CONSER HEAT OF REJECTION = 1355 TONS

TOTAL TOWER LOAD = 2075 TONS

FRY EQUIPMENT CO., INC.

2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442

FAX: (303) 922-8445

DATE: 3 APRIL 92 ALSO TOM & A

TRANSMITTED TO: EMC

ATTENTION: CHET BUTLER FROM: LOU COLOMAS

SUBJECT: WHITE SANDS MISSILE RANGE

This Transmission Consists of 3 Pages Including This Page.

BUDGET PRICING FOR STEAM TURBINES / INDUSTRIAL CHILL

(A)

	$ EACH
175 TON CHILLER, DUNHAM-BUSH # IPCX-180 WITH FRAME TO ACCEPT TURBINE, 158 H.P.	# 94,000
375 TON CHILLER, DUNHAM-BUSH # IPCX-375 WITH FRAME TO ACCEPT TURBINE, 375 H.P	# 121,000
550 TON CHILLER, DUNHAM-BUSH # IPCX-580 WITH FRAME TO ACCEPT TURBINE, 495 H.P.	# 158,000

(B)

158 H.P STEAM TURBINE, COPPUS # RLHA-19	$ 23,000
375 H.P STEAM TURBINE, COPPUS # RLHA-24	# 28,500
550 H.P STEAM TURBINE, COPPUS # RLHA-28	$ 32,000

350

TURBINES WERE SELECTED ON 125 PSIG INLET, 30 PSIG OUT

158 H.P TURBINE → 68.4 lbs/HR/HP → 10,814 lbs/HR

375 H.P. TURBINE → 64 lbs/HR/HP → 24,000 lbs/HR

550 H.P TURBINE → 55.4 lbs/HR/HP → 27,436 lbs/HR

OUR PURPOSE - Helping Others Get What They Want

FRY EQUIPMENT CO., INC.
2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442
FAX: (303) 922-8445

DATE: 9 NOV 92
TRANSMITTED TO: EMC
ATTENTION: Chet Buttler FROM: Lou Grounds
SUBJECT: COOLING TOWER / pumps – White SANDS
This Transmission Consists of 1 Pages Including This Page.

Chet:

Two variations on COOLING TOWERS / pumps.
Depending upon how you determine "TOTAL heat rejections" from the chillers, as follows:

A. Conservative method, 2717 GPM, ADDED HEAT OF Compression

COOLING TOWER → TOWER TECH # TTMT-144-312, QTY-2 CELLS, 2717 GPM, 92°F → 80°F, 68°FWB 60 H.P. Price: $ 44,000

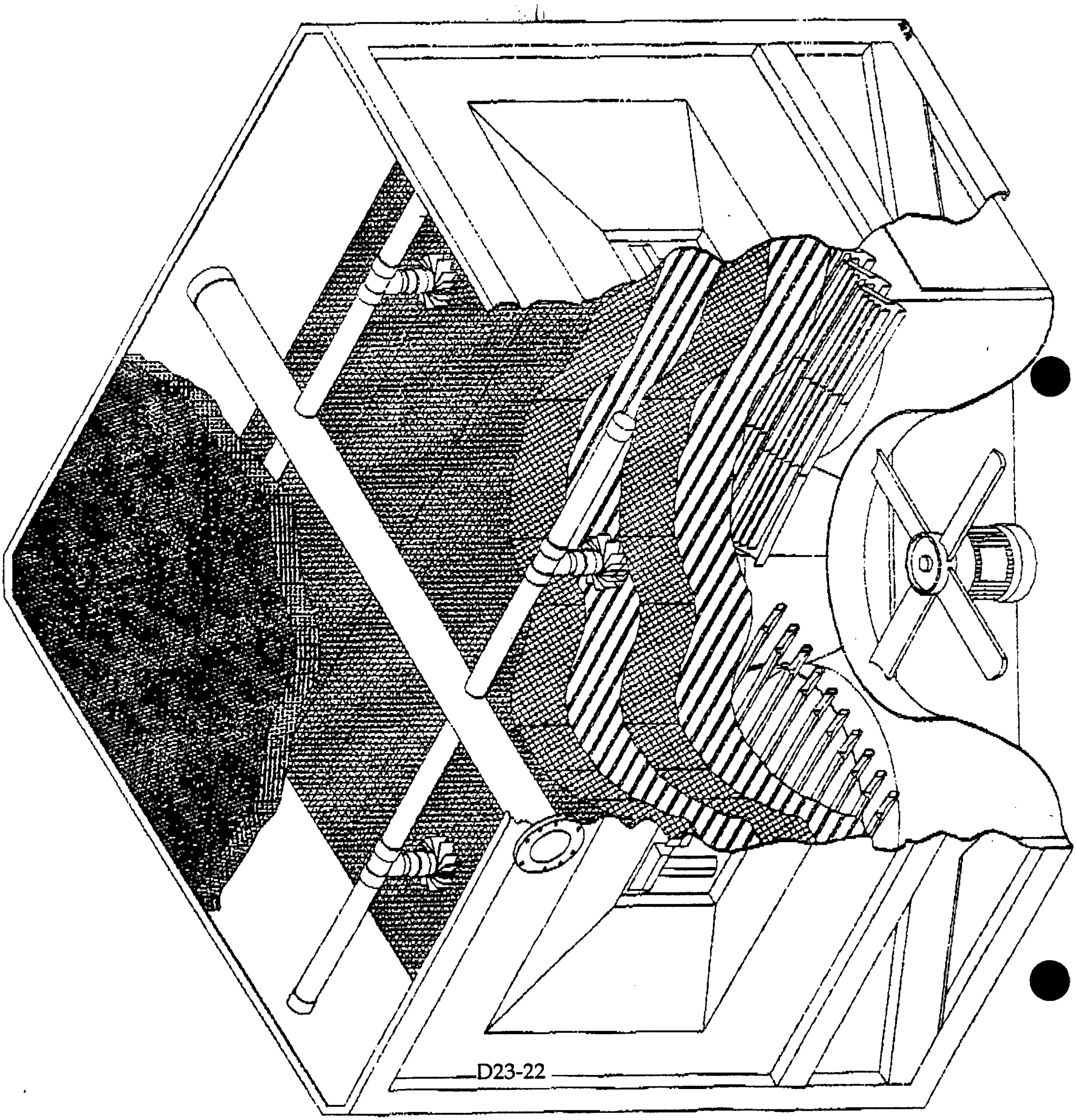
pumps, condenser water → DUNHAM-BUSH, THREE @ 906 GPM/EACH, 65' HEAD #20 HP-4 BQC-9", $1900 each x 3 = $5700.00

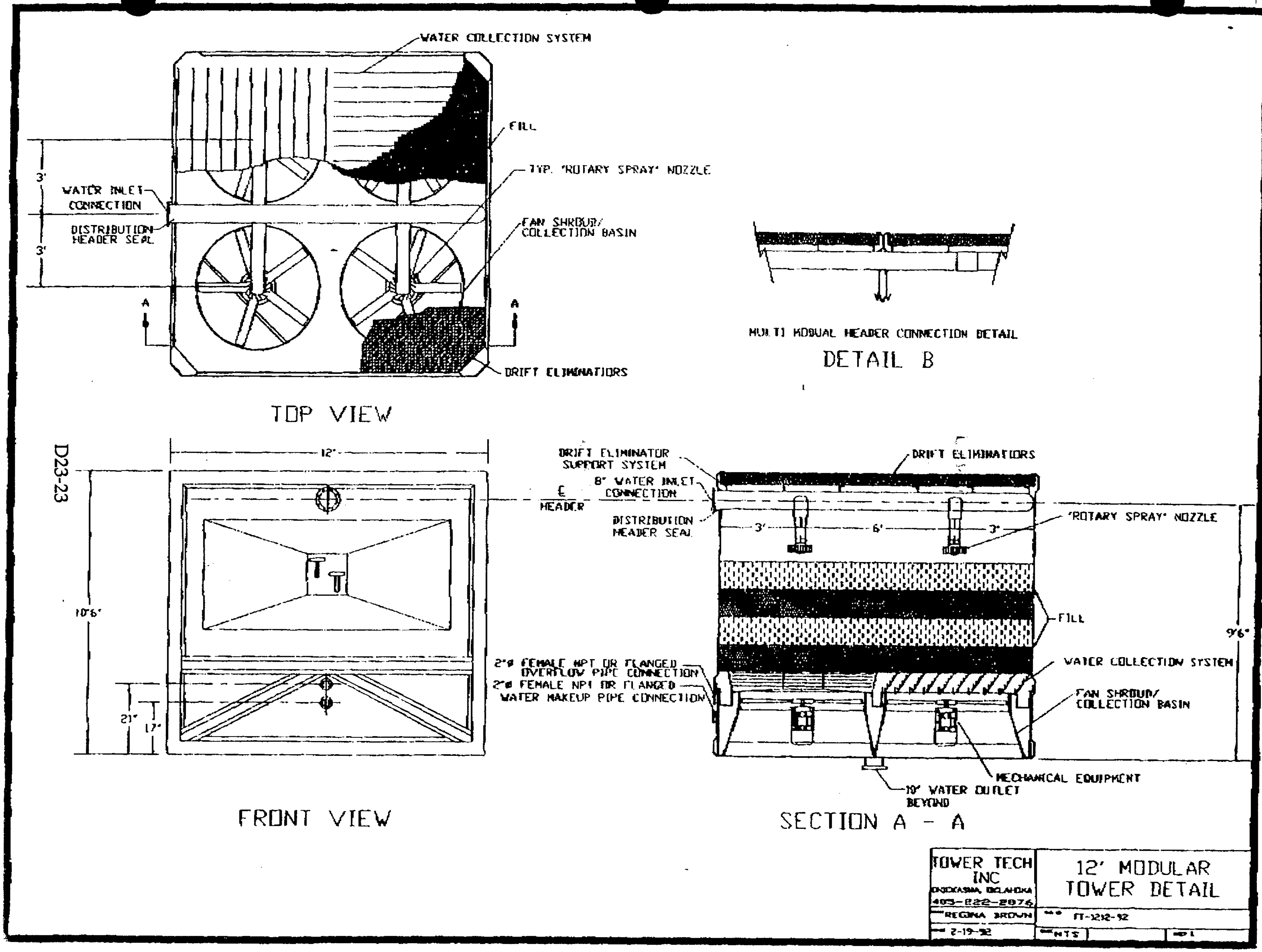
B. LEAST COSTLY METHOD, ASSUMING HIGH EFFICIENCY DUNHAM-BUSH CHILLERS 0.6 to 0.8 HP/TON, 80°F condenser water.

COOLING TOWER → TOWER TECH # TTMT-144-019, QTY-2 cells 1600 GPM, 92°F → 80°F, 68°F WET BULB, 32 HP FAN
Price: $ 38,000

D23-21

Condenser water pumps → DUNHAM-BUSH, TWO @ 800 GPM each, 65' HEAD, Model No.


D23-22



WATER COLLECTION SYSTEM
FILL
TYP. 'ROTARY SPRAY' NOZZLE
FAN SHROUD/ COLLECTION BASIN
DRIFT ELIMINATORS
WATER INLET CONNECTION
DISTRIBUTION HEADER SEAL
3'
3'
A
A
TOP VIEW
MULTI MODUAL HEADER CONNECTION DETAIL
DETAIL B
12'
10'6"
21"
17"
FRONT VIEW
DRIFT ELIMINATOR SUPPORT SYSTEM
8" WATER INLET CONNECTION
℄ HEADER
DISTRIBUTION HEADER SEAL
2"ø FEMALE NPT OR FLANGED OVERFLOW PIPE CONNECTION
2"ø FEMALE NPT OR FLANGED WATER MAKEUP PIPE CONNECTION
DRIFT ELIMINATORS
'ROTARY SPRAY' NOZZLE
3'
6'
3'
FILL
9'6"
WATER COLLECTION SYSTEM
FAN SHROUD/ COLLECTION BASIN
MECHANICAL EQUIPMENT
10" WATER OUTLET BEYOND
SECTION A - A
TOWER TECH INC
OKLAHOMA, OKLAHOMA
405-822-2876
REGINA BROWN
2-19-92
12' MODULAR TOWER DETAIL
TT-1212-92
NTS
1

E M C ENGINEERS, INC.
Denver • Atlanta • Germany

JOB WSMR ESOS STUDY #1110-000
SHEET NO. 1 OF 2
CALCULATED BY CB DATE 11-06-92
CHECKED BY TF DATE 11-09-92
SCALE

SURFACE CONDENSER PUMP:

1355 T. × 1074 BTU/lb. × 11.2 lb/Hr·T.R. = 16,300,000 BTUH.

$$GPM = \frac{16,300,000 \text{ BTUH}}{500\ (92-80)} = \frac{16,300,000}{6,000} = 2717$$

PUMP HD
CONDENSER P.D. 15'
PIPING P.D. 20'
ELEV'N HD 30'
65'

$$\text{PUMP BHP} = \frac{2717 \text{ GPM} \times 65' \text{ HD} \times 1.0 \text{ SP GR.}}{3960 \times 0.90 \text{ eff.}} = 49.55$$

$$\text{MOTOR HP} = \frac{\text{PUMP BHP}}{\text{MOTOR EFF}} = \frac{49.55}{0.9} = 55$$

$$\text{KW INPUT} = \frac{\text{PUMP BHP} \times 0.7457}{\text{MOTOR EFF.}} = \frac{49.55 \times 0.7457}{0.90} = 41.1 \text{ KW}$$

USE 60 HP MOTOR. TO AVOID PUMP O'LOAD IF HEAD GOES TOO'.

E M C ENGINEERS, INC.
Denver • Atlanta • Germany

JOB
SHEET NO. 2 OF 2
CALCULATED BY CB DATE 11-06-92
CHECKED BY TF DATE 11-09-92
SCALE

COND. PUMP FOR CHILLER:

CHILLER SIZE 720 T.R.

@ 3 gpm / T.R. = 720 x 3 = 2250 gpm.

$$\text{PUMP BHP} = \frac{2250 \text{ gpm} \times 70' \text{ Hd}^{*} \times 1 \text{ sp.gr.}}{3960 \times 0.90 \text{ eff.}} = 44.2$$

$$\text{MOTOR HP} = \frac{\text{PUMP BHP}}{\text{MOTOR EFF}} = \frac{44.2}{0.90} = 49$$

$$\text{KW INPUT} = \text{PUMP BHP} \times 0.7457 / \text{MOTOR EFF.} = \frac{44.2 \times 0.7457}{0.90}$$

$$= 36.7 \text{ KW.}$$

* PUMP HP

CHILLER P.D. = 20'
Piping P.D = 20'
Elev'n Hd = 30'
70'

USE 60 HP TO PREVENT O'LOADING MOTOR IF HEAD GOES TO 0'

FRY EQUIPMENT CO., INC.
2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442
FAX: (303) 922-8445

DATE: 9 NOV 92

TRANSMITTED TO: EMC

ATTENTION: TOM FORSTER Chet Butler FROM: LOU GROUNDS

SUBJECT: White SANDS FEASIBILITY STUDY

This Transmission Consists of 7 Pages Including This Page.

TOM: TWO-STAGE EVAPORATIVE COOLER WITH MIST ELIMINATORS TO COOL THE INLET AIR AND ADD MOISTURE FOR THE GAS TURBIN

QTY

1 - 7000 ACFM AIR FLOW, Engineered Commercial Concepts Inc model # INTPS-13, Capacity to reduce 98°FDB/68°FWB to 66°FDB/64°FW with two-2HP Induct air stream scavenger fans and one 5H.P. primary air supply fan MIST Eliminator will pass a maximum of 0.002 percent of droplets at a maximum size 61 micr

BUDJET price: $ 17,200.00

EVAP COOLER FOR GAS TURBINE INLET

LOWERS: 98°FDB ⟶ 66°FDB/64°FWB
7000 ACFM INTO GAS TURBINE

Project White SANDS Date 9 NOV 92
System TWO STAGE EVAP. By LOU GROUNDS

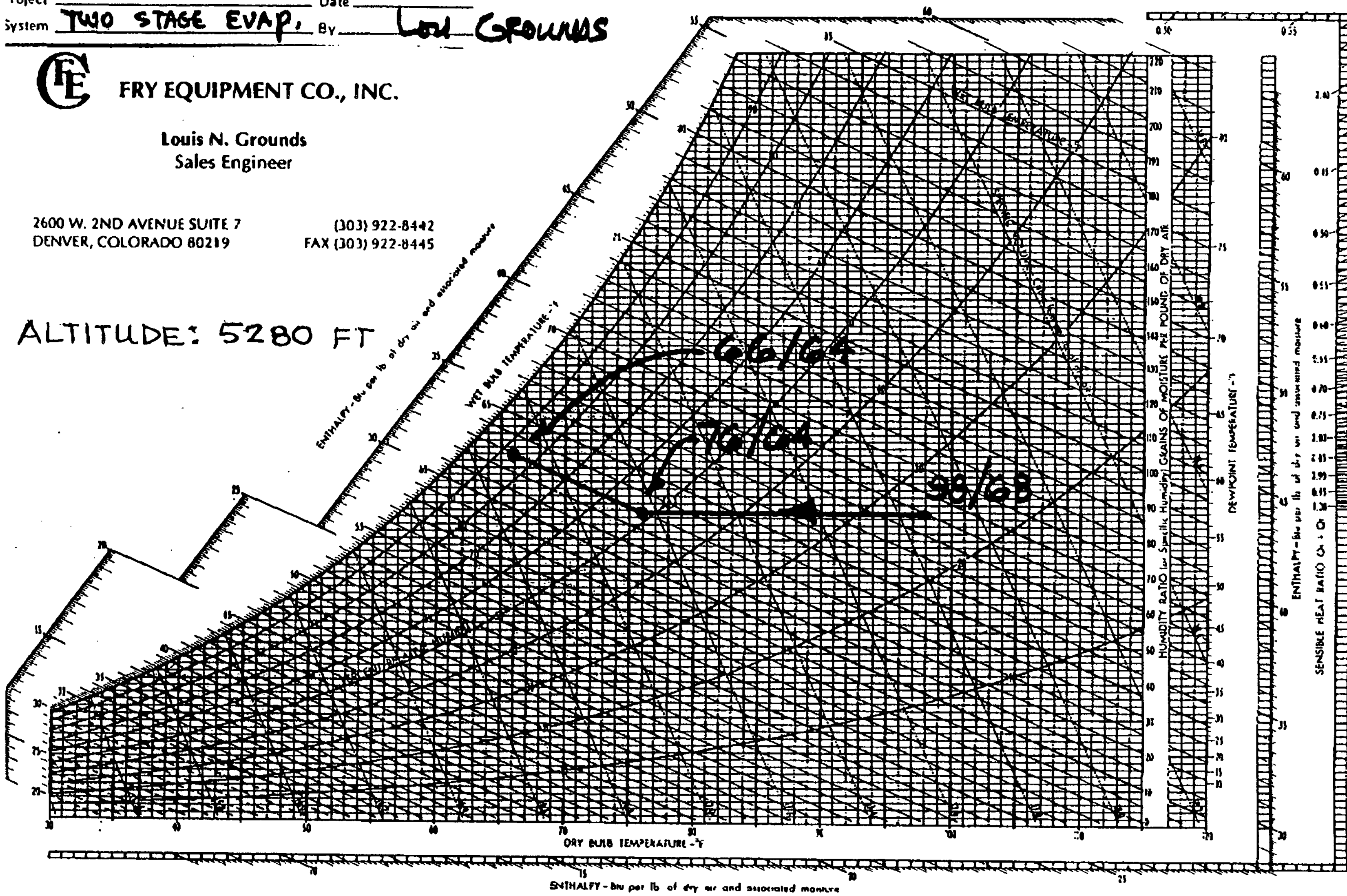
FRY EQUIPMENT CO., INC.

Louis N. Grounds
Sales Engineer

2600 W. 2ND AVENUE SUITE 7
DENVER, COLORADO 80219

(303) 922-8442
FAX (303) 922-8445

ALTITUDE: 5280 FT



E M C ENGINEERS, INC.	JOB WSMR ESOS STUDY #1110-000
Denver • Colorado Springs • Atlanta • Germany	SHEET NO. 3 OF
	CALCULATED BY TR DATE 11-04-92
	CHECKED BY DATE
	SCALE

TECH AREA ALT #3

SURFACE CONDENSER SIZING.

REJECTED HEAT CALCULATION: 0# STEAM MUST BE CONDENSED (980 BTU/LB).

PLANT COOLING LOAD (TONS)	STEAM FLOW RATE (LB/HR)	HEAT OF CONDENSATION (MBtu/hr.) / (TONS)
100	5,970	5.85 / 487.5
200	6,281	6.16 / 513.3
300	11,245	11.02 / 918.3
400	10,307	10.10 / 841.7
500	17,767	17.41 / 1451.8
600	16,588	16.26 / 1355.0

$\boxed{\text{SIZE SURFACE CONDENSER AT 16.26 MBTU/HR}}$

$\boxed{\text{SIZE COOLING TOWER:}}$

HEAT OF REJECTION FROM CHILLERS = $600 \text{ TONS} \times (1 + \frac{1}{COP})$

= 600 X 1.2 = 720 TONS

SURF. CONDENSER HEAT OF REJECTION = 1355 TONS

TOTAL TOWER LOAD = 2075 TONS.

SIZE COOLING TOWER @ 2,100 TONS

E M C ENGINEERS, INC.

Denver • Atlanta • Germany

JOB

SHEET NO. OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

ON PEAK - GAS TURBINE / GENERATOR W/ HRSG.

AUX. BOILER OR DUCT BURNER ON HRSG

STM TURBINE - DRIVEN ROT. SCREW COMPRESSOR CHILLERS.

365d x 10h/d = 3,650 hr/year.

OFF PEAK — 200 TON CENT. CHILLER (ELEC. DRIVEN)

AUX BOILER FOR T.A. STEAM LOAD

365d x 14h/d = 5110 hr/yr.

JOB

SHEET NO. OF

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY DATE

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SCALE

HRSG : 4000 LB/HR @ 125#

1991 Means: p 151

	MAT'L	Labor	SUB TOT	OHP	TOT
1152440 :	$23,050	5,575	28,625	5,075	$33,700

ESCALATE TO 1993 @ 5%.

$(1.05)^2 = 1.1025$

$33,700 \times 1.1025 = \$37,200 \simeq \$37,000$

HRSG : 7100 LB/HR @ 125# (ESTIMATED PRICES)

8.478 MBtu

MAT'L	LABOR	SUBTOT	OHP.	TOT.
$56,800	12,000	68,800	12,200	$81,000

ESCALATE: $(1.05)^2 = 1.1025$

$1.1025 \times \$81,000 =$ $~~\$89,300~~$ $\$89,300$

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

JOB WSMR ESUS STUDY #1110-000

SHEET NO. 1 OF 3

CALCULATED BY TF DATE 11-06-92

CHECKED BY JZ DATE 11-12-92

SCALE

ALT #3 PERF. SUMMARY (500 KW GEN. SET)

	ON PEAK	OFF PEAK	TOTAL
Elec. (kWh)	332,150	(909,916)	(577,766)
DEMAND (KW)	91 X 12	—	1,092
GAS. (MBTU)	(51,511)	(7,110)	(~~58~~,261)
AVOIDED ELEC (kWh)	1,411,300	—	1,411,300
DEMAND (KW)	4,980		4,980
AVOIDED GAS	7,905	—	7,905
TOT. ELEC. SAVINGS (kWh/yr)			833,534
TOT. ANN. DEMAND SAVINGS (KW)			6,072
TOT. ANN GAS SVGS (MBTU)			(50,716)

CONSTR COST ≈ $ 4,364,493

SIR = −.18

SPB = − 155 YRS

E M C ENGINEERS, INC.
Denver • Colorado Springs • Atlanta • West Germany

JOB WSMR ESOS STUDY #1110-000
SHEET NO. 2 OF 3
CALCULATED BY TF DATE 11-06-92
CHECKED BY JF DATE 11-12-92
SCALE

ALT #3 ON PEAK ANALYSIS

500 KW GAS TURBINE GENERATOR SET (422 KW DERATED)
HRSG W/ 4000 LB/HR OF 125 PSIG STEAM
AUX. BOILER - 11,000 LB/HR OF 125 PSIG STEAM

	JAN	FEB	MAR	APR	MAY	JUN
HOURS/MO	310	280	310	300	310	300
AVE. COOLING LOAD (TONS)	36	47	104	217	417	500
CHILLER PART LOAD	.18	.24	.52	1.08	.70	.83
CHILLER HP	38	45	76	162	326	378
TURBINE STM FLOW (LB/HR)	1,700	1,900	2,900	6,400	10,500	12,700
TECH AREA STM FLOW (LB/HR)	676	540	345	345	345	345
TOT. STM LOAD (LB/HR)	2,376	2,440	3,245	6,745	10,845	13,045
HRSG STM PRODUCTION (LB/HR)	2,376	2,440	3,245	4,000	4,000	4,000
AUX BOILER (LB/HR)	0	0	0	2,745	6,845	9,045
GAS TURB * FUEL (MBTU/HR)	7.458	7.458	7.458	7.458	7.458	7.458
BOILER FUEL (MBTU/HR)	0	0	0	4.37	10.884	14.383
GAS PURCHASE (MBTU/MO)	2,312	2,088	2,312	3,547	5,686	6,552
GENERATOR OUTPUT (KW)	422	422	422	422	422	422
PLANT ELEC (KW)	331	331	331	331	331	331
NET KW	91	91	91	91	91	91
NET KWH/MO	28,210	25,480	28,210	27,300	28,210	27,300

* 16,216 BTU/KW-HR 422 KW $\times \frac{1031 \text{ BTU/CF}}{946 \text{ BTU/CF}}$ = 7.458 MBTU/HR

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 3 OF 3

CALCULATED BY TF DATE 11-06-92

CHECKED BY JE DATE 11-12-92

SCALE

ALT #3 ON PEAK ANALYSIS

500 KW GAS TURBINE GENERATOR SET
HRSG W/ 4000 LB/HR OF 125 PSIG STEAM
AUX. BOILER - 11,000 LB/HR OF 125 PSIG STEAM

	JUL	AUG	SEP	OCT	NOV	DEC
HOURS/MO	310	310	300	310	300	310
AVE. COOLING LOAD (TONS)	514	500	427	231	83	48
CHILLER PART LOAD	.86	.83	.71	.58	.42	.24
CHILLER HP	412	407	309	172	55	45
TURBINE STM FLOW (LB/HR)	14,400	13,900	11,700	5,900	2,950	1,900
TECH AREA STM FLOW (LB/HR)	345	345	345	345	345	444
TOT. STM LOAD (LB/HR)	14,745	14,245	12,045	6,245	3,395	2,344
HRSG STM PRODUCTION (LB/HR)	4,000	4,000	4,000	4,000	3,395	2,344
AUX BOILER (LB/HR)	10,745	10,245	8,045	2,245	0	0
GAS TURB FUEL (MBTU/HR)	7.458	7.458	7.458	7.458	7.458	7.458
BOILER FUEL (MBTU/HR)	17.086	16.291	12.793	3.570	0	0
GAS PURCHASE (MBTU/MO)	7,609	7,362	6,075	3,419	2,237	2,312
GENERATOR OUTPUT (KW)	422	422	422	422	422	422
PLANT ELEC (KW)	331	331	331	331	331	331
NET KW	91	91	91	91	91	91
NET KWh/MO	28,210	28,210	27,300	28,210	27,300	28,210

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF 3

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY TF DATE 11-06-92

CHECKED BY JS DATE 11-12-92

SCALE

ALT 3 PERFORMANCE SUMMARY
(875 KW GEN SET)

	ON PEAK	OFF PEAK	TOTAL
ELEC (kWh)	1,299,400	(909,916)	389,484
DEMAND (kW)	4,272	—	4,272
GAS (MBTU)	(57,857)	(7,110)	(64,967)
AVOIDED ELEC (kWh)	1,411,300		1,411,300
AVOIDED DEMAND (kW)	4,980		4,980
AVOIDED GAS (MBTU)			7,905
TOTAL ANN. ELEC SAVINGS (kWh)			1,800,784
TOT. DEMAND REDUCTION (kW)			9,252
TOT ANN GAS SAVINGS (MBTU)	—	—	(57,062)

CONST'N COST ≃ $ 4,813,733

SIR = 0.01

SPB = 142

JOB WSMR ESOS STUDY #1110-000

SHEET NO 2 OF 3

E M C ENGINEERS, INC.

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CALCULATED BY TF DATE 11-06-92

CHECKED BY JZ DATE 11-12-92

ALT #3 ON PEAK ANALYSIS

SCALE

875 KW GAS TURBINE GENERATOR SET (750 KW DERATED)
HRSG W/ 7,109 LB/HR OF 125 PSIG STEAM
AUX. BOILER: 7,700 LB/HR OF 125 PSIG STEAM

	JAN	FEB	MAR	APR	MAY	JUN
HOURS/MO	310	280	310	300	310	300
AVE. COOLING LOAD (TONS)	36	47	104	217	417	500
CHILLER PART LOAD	.18	.24	.52	1.08	.70	.83
CHILLER HP	38	45	76	162	326	378
TURBINE STM FLOW (LB/HR)	1,700	1,900	2,900	6,400	10,500	12,700
TECH AREA STM FLOW (LB/HR)	472.6	397.9	345	345	345	345
TOT. STM LOAD (LB/HR)	2,173	2,298	3,245	6,745	10,845	13,045
HRSG STM PRODUCTION (LB/HR)	2,173	2,298	3,245	6,745	7,109	7,109
AUX BOILER (LB/HR)	0	0	0	0	3,736	5,936
GAS TURB * FUEL (MBTU/HR)	11.93	11.93	11.93	11.93	11.93	11.93
BOILER FUEL (MBTU/HR)	0	0	0	0	5.94	9.44
GAS PURCHASE (MBTU/MO)	3,698	3,340	3,698	3,579	5,540	6,411
GENERATOR OUTPUT (KW)	750	750	750	750	750	750
PLANT ELEC (KW)	356	356	356	356	356	356
NET KW	394	394	394	394	394	394
NET KWH/MO	122,140	110,320	122,140	118,200	122,140	118,200

$$* \; 14{,}594 \; \text{BTU/KW-HR} \times 750 \; \text{KW} \times \frac{1031 \; \text{BTU/CF}}{946 \; \text{BTU/CF}} = 11.93 \; \frac{\text{MBTU}}{\text{HR}}$$

JOB WSMR ESCOS STUDY #1110-000

SHEET NO 3 OF 3

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY TF DATE 11-06-92

CHECKED BY JS DATE 11-12-92

SCALE

ALT #3 ON PEAK ANALYSIS

875 KW GAS TURBINE GENERATOR SET (750 KW DERATED)
HRSG W/ 7,109 LB/HR OF 125 PSIG STEAM
AUX. BOILER: 7,700 LB/HR OF 125 PSIG STEAM

	JUL	AUG	SEP	OCT	NOV	DEC
HOURS/MO	310	310	300	310	300	310
AVE. COOLING LOAD (TONS)	514	500	427	231	83	48
CHILLER PART LOAD	.86	.83	.71	.58	.42	.24
CHILLER HP	412	407	339	172	55	45
TURBINE STM FLOW (LB/HR)	14,400	13,900	11,700	5,900	2,950	1,900
TECH AREA STM FLOW (LB/HR)	345	345	345	345	345	356.5
TOT. STM LOAD (LB/HR)	14,745	14,245	12,045	6,245	3,295	2,257
HRSG STM PRODUCTION (LB/HR)	7,109	7,109	7,109	6,245	3,295	2,257
AUX BOILER (LB/HR)	7,636	7,136	4,946	0	0	0
GAS TURB FUEL (MBTU/HR)	11.93	11.93	11.93	11.93	11.93	11.93
BOILER FUEL (MBTU/HR)	12.14	11.35	7.86	0	0	0
GAS PURCHASE (MBTU/MO)	7,462	7,217	5,937	3,698	3,579	3,698
GENERATOR OUTPUT (KW)	750	750	750	750	750	750
PLANT ELEC (KW)	356	356	356	356	356	356
NET KW	394	394	394	394	394	394
NET KWh/MO	122,140	122,140	118,200	122,140	118,200	122,140

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 1 OF 3

E M C ENGINEERS, INC.

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CALCULATED BY TF DATE 11-06-92

CHECKED BY DATE

SCALE

ALT #3 OFF PEAK ANALYSIS

	JAN	FEB	MAR	APR	MAY	
OFF PEAK HOURS/MO	434	392	434	420	434	
AVE. COOLING LOAD (TONS)	15	18	28	48	104	
CHILLER PART LOAD	.08	.09	.14	.24	.52	
CHILLER KW/TON	1.59	1.42	0.96	0.70	0.55	
CHILLER DRIVE (KW)	24	25.5	27	34	57	
PLANT AUX ELEC (KW)	115	115	115	115	115	
TOT. PLANT ELEC (KW)	139	140.5	142	149	172	
TOT PLANT ELEC (KWH/MO)	60,326	55,076	61,628	62,580	74,648	
TECH AREA STM LOAD (LB/HR)	4,430	1,915	1,192	83	83	
BOILER @0.75 eff FUEL MBTU/HR	7.044	3.045	1.895	0.132	0.132	
GAS PURCHASED MBTU/MO	3,057	1,194	822.6	55.4	55.4	
ELEC KWH PURCHASED/MO						

$$\text{BOILER FUEL} = \left[X \left(\frac{LB}{HR}\right) \times 1192.6 \frac{BTU}{LB} \Big/ 0.75 \right] \times 10^{-6} \frac{MBTU}{HR}$$

	JOB	WSMR ESOS STUDY #1110-000
	SHEET NO.	2 OF 3
E M C ENGINEERS, INC.	CALCULATED BY	TF DATE 11-06-9
Denver • Atlanta • Germany	CHECKED BY	DATE
ALT #3 OFF PEAK ANALYSIS	SCALE	

	JUN	JUL	AUG	SEP	OCT	
OFF PEAK HOURS/MO	420	434	434	420	434	
AVG. COOLING LOAD (TONS)	204	229	198	83	42	
CHILLER PART LOAD	1.02	1.145	0.99	.42	.21	
CHILLER KW/TON	0.59	0.55	0.60	0.56	.76	
CHILLER DRIVE (KW)	121	127	119	46	32	
PLANT AUX ELEC (KW)	133	133	133	133	133	
TOT. PLANT ELEC (KW)	254	260	252	179	165	
TOT PLANT ELEC (KWH/MO)	106,680	112,840	109,368	75,180	71,610	
TECH AREA STM LOAD (LB/HR)	83	83	83	83	120	
BOILER FUEL MBTU/HR	0.132	0.132	0.132	0.132	0.191	
GAS PURCHASED MBTU/MO.	55.4	55.4	55.4	55.4	82.8	
ELEC KWH PURCHASED/MO						

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 3 OF 3

CALCULATED BY TF DATE 11-06-92

CHECKED BY ______ DATE ______

SCALE ______

E M C ENGINEERS, INC.

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ALT #3 OFF PEAK ANALYSIS

	NOV	DEC		ANNUAL TOTAL		
OFF PEAK HOURS/MO	420	434				
AVG. COOLING LOAD (TONS)	25	16				
CHILLER PART LOAD	.13	.08				
CHILLER KW/TON	1.04	1.56				
CHILLER DRIVE (KW)	26	25				
PLANT AUX ELEC (KW)	115	115				
TOT. PLANT ELEC (KW)	141	140				
TOT PLANT ELEC (KWH/MO)	59,220	60,760		909,916		
TECH AREA STM LOAD (LB/HR)	520	1,846				
BOILER FUEL MBTU/HR	0.827	2.935				
GAS PURCHASED MBTU/MO.	347.3	1,274		7,110		
ELEC KWH PURCHASED/MO				909,916		

E M C ENGINEERS, INC.
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JOB WSMR ESOS STUDY #1110-000
SHEET NO. 1 OF 6
CALCULATED BY C.B. DATE
CHECKED BY TF DATE 3/31/92
SCALE

STL CARRIER PIPE W/ 2 MIN. WOOL INSULATION IN STEEL CONDUIT & CATHODIC PROTECTN.
CARRIER PIPE — (IN TRENCH W/ 4' MIN BACKFILL.)

SIZE	LENGTH	$/LF	TOTAL
10"	84 LF	156.0	13,104
8"	570 LF	131.62	75,023
6"	1735	111.57	193 574
5"	1149	102 -	117,198
4"	980	93 -	91,140
3"	1,076	84 -	90,384
2½	269	78	20,982
2	284	74	21,016
	6,147		$622,421

STL CARRIER PIPE SAME AS ABOVE EXCEPT SCH. 80. W/1" MIN. WOOL.

SIZE	LENGTH	$/LF	TOTAL
3"	84	74	6,216
2-1/2"	910 LF	69 -	62,790
2"	2544 LF	65 -	165,360
1-1/2"	1971 LF	61 -	120,231
1-1/4"	488 LF	59	28,792
1"	150 LF	56	8 400
	6147		$ 391,789

MANHOLES (INCL EXPANSION JOINTS, ISOLATION VALVES, TRAPS, ANCHORS, VAULT.)

PIPE SIZE	QTY	PRICE ~~EA~~.	TOTAL.
8"	3	11,070	33,210
6"	8	9051	72,408
5"	3	8800	26,400
4"	3	8200	24,600
			$156,618

TOTAL STEAM & CONDENSATE PIPING; MANHOLES $1,170,828

E M C ENGINEERS, INC.

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JOB

SHEET NO. 2 OF 6

CALCULATED BY CB / AN DATE 3-31-92

CHECKED BY TF DATE

SCALE

BLDG. No.	PEAK HEATING LOAD (KBTUH)	STEAM USAGE (lb/Hr.)
1504	1,087.4	1171
1506	2,550.0	2745
1510	1,491.2	1605
1512	2840.0	3057
1526	1,268.7	1366
1528	297.5	320
1530	1,341.4	1,444
1534	1,003.0	1,080
1538	1,042.8	1,123
1540	762.9	821
1544	1,130.5	1,217
1550	785.3	845
1554	792.8	853
1558	564.1	607
1621	1,632.0	1,757
1622	1,422.9	1,532
1623	310.0	334
1624	1,631.3	1,756
1644	778.1	838
1646	767.7	826
1648	559.9	603
1649	301.2	324
1650	306.6	330
1676	534.6	575
1678	1,130.9	1,217
1680	755.1	813
1690	222.2	239

JOB WSMR ESOS STUDY #1110-000

SHEET NO. 3 OF 6

E M C ENGINEERS, INC.

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CALCULATED BY A. Niemeyer DATE 4-2-92

CHECKED BY DATE

SCALE

COST ESTIMATE FOR
CONDENSATE RETURN SYSTEM PUMPS &
HEATING SYSTEM CONVERSIONS. (Overhead & Profit not included)

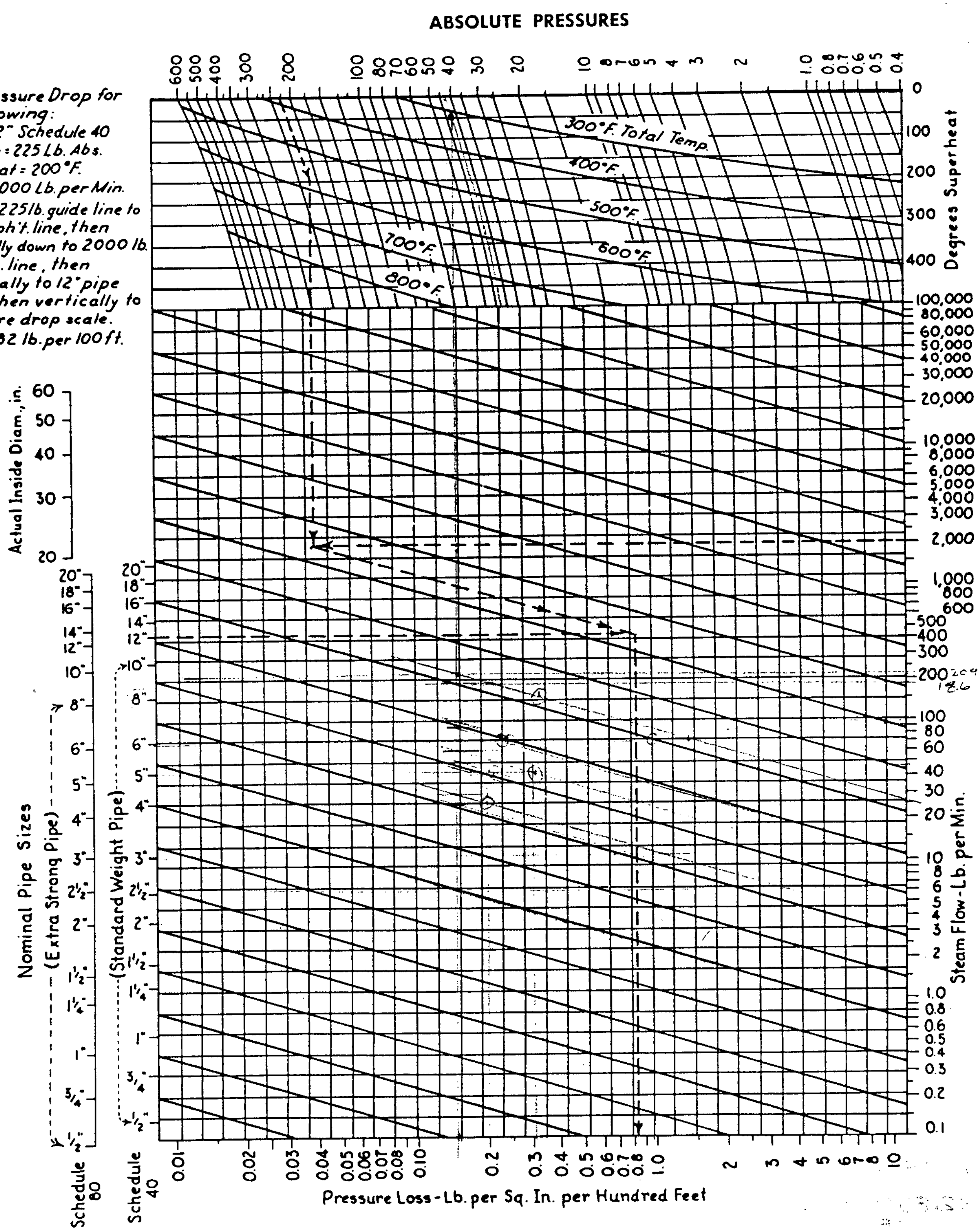
BLDG. NO.	CONDENSATE RETURN SYST. PUMPS ($)	STEAM TO H.W. HEAT EXCHANGERS ($)	(NO BOILER) HEATING SYSTEMS ** (Hydronic w/ Unit Heaters) ($)	TOTAL COST PER BLDG. ($)
1504	3,430	1,000		4,430
1506	3,430			4,430
1510	3,430			4,430
1526	3,430			4,430
*1538	3,430		73,000	77,430
1621	3,430			4,430
1623	3,430			4,430
1624	3,430			4,430
*1646	3,430		53,740	58,170
*1648	3,430		39,194	43,624
1649	3,430			4430
*1650	3,430		21,459	25,889
1676	3,430			4,430
1678	3,430			4,430
1680	3,430			4,430
*1690	3,430		15,557	19,987
	54,880	16,000	202,950	273,830

* BLDGS W/ FORCED AIR N.G. HEATERS

** $2.80/SF Mat. & Lab. Cost (No Overhead & Profit)

Graphical Solution of UNWIN's Formula

Find Pressure Drop for the following:
Pipe = 12" Schedule 40
Pressure = 225 Lb. Abs.
Superheat = 200 °F.
Flow = 2,000 Lb. per Min.
Follow 225 lb. guide line to 200° suph't. line, then vertically down to 2000 lb. per min. line, then diagonally to 12" pipe diam., then vertically to pressure drop scale.
Ans: 0.82 lb. per 100 ft.



E M C ENGINEERS, INC.

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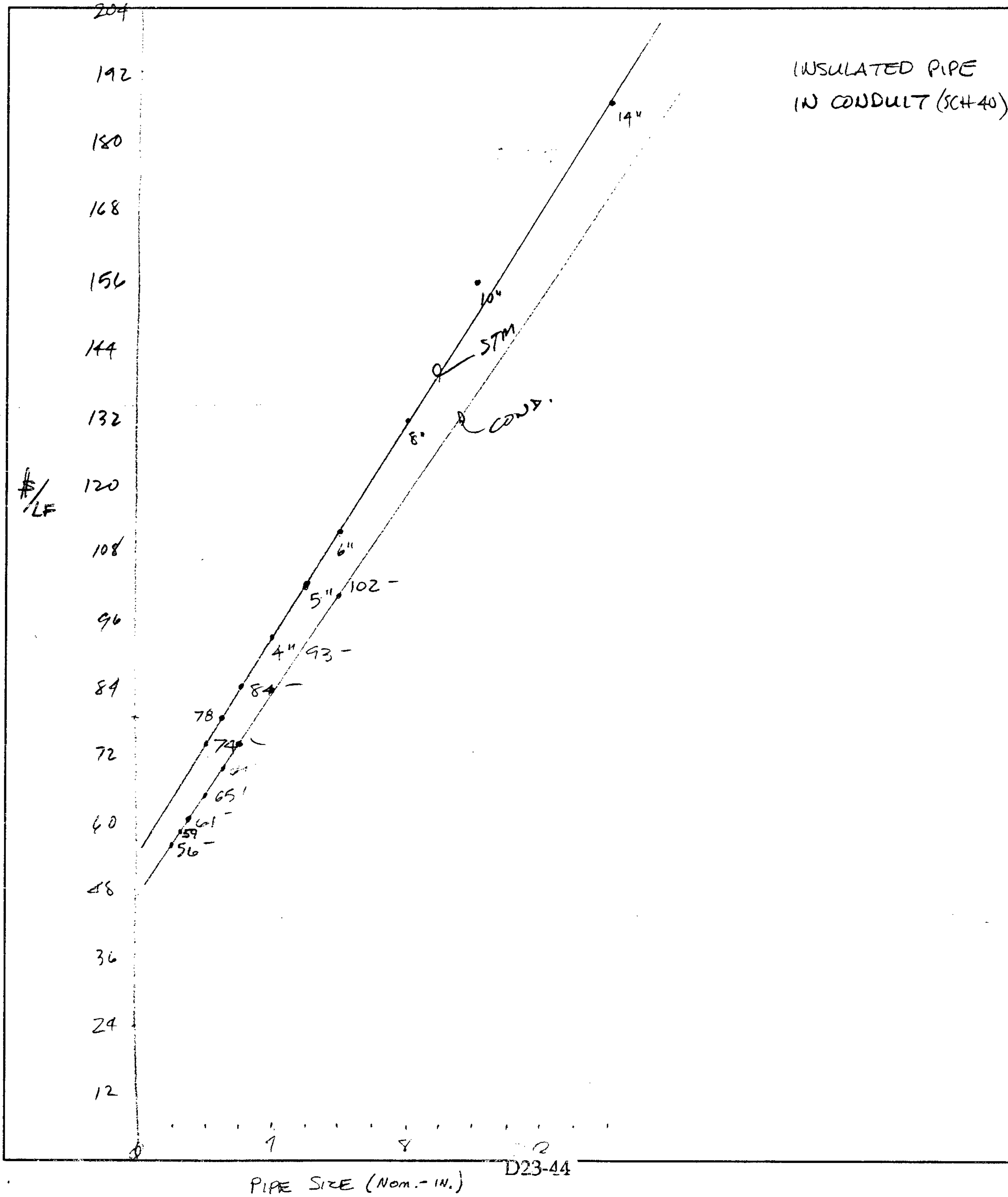
JOB

SHEET NO. 6 OF 6

CALCULATED BY CB DATE

CHECKED BY TF DATE

SCALE



BY A.N. 3-31-92
CHECKED BY TJF 3-31-92

TECH AREA

BLDG. No.	EXISTING BOILER CAP. (BTUH)	Peak DESIGN LOAD TRACE ANALYSIS (for Htg) (BTUH)	EST. Process & Misc. Loads. (BTUH)	Peak Heat Load (BTUH) (use to size steam lines)
STM PLT BLDG. 1544	3 at 5,808,000 (N.G.)			
1506	E. & W. ZONES 2,625,000 STM W. Addition 780,000 HW	739,790	280,000	2,550,000
1512	5,680,000 STM	280,704	500,000	2,840,000
1526	2,200,000 HW	645,808	200,000?	1,268,700
1528	STM from BLDG. 1544	222,506	375,000?	
1530	STM from BLDG. 1544	1,341,433	—	—
1621	1,632,000 HW	259,068	100,000(?)	1,632,000
1622	2,318,250 STM	698,623	250,000	1,422,900
1623	310,000 HW	247,986		310,000
1624	2,175,000 HW	685,107	500,000	1,631,250

1644	19453 ⌀ x 40 BTUH/SF = 778,120 BTUH	1538	26,071 ⌀ X 40 = 1,042,840 BTUH
1646	19,193 ⌀ X 40 BTUH/SF = 767,720 BTUH	1649	7530 ⌀ X 40 = 301,200 BTUH
1648	13,998 ⌀ X 40 BTUH/SF = 559,920 BTUH	1650	7664 ⌀ X 40 = 306,560 BTUH
1676	13,364 ⌀ X 40 BTUH/SF = 534,560 BTUH	1504	27,185 ⌀ X 40 = 1,087,400 BTUH
1678	28,272 ⌀ X 40 = 1,130,880 BTUH	1510	3,728 ⌀ X 40 = 149,120 BTUH
1680	18,877 ⌀ X 40 = 755,080 BTUH		
1690	5556 ⌀ X 40 = 222,240 BTUH		

JOB # PROJECT:

BY: A.N. DATE: 3-31-92 CK BY: TJF DATE: 3-31-92

PAGE OF

Additional Bldgs. in Tech Area
that have existing steam distribution lines,
but need to be included on New Cogen Plant.

BLDG. No.	SF		Htg. Cap. (BTUH)
1540	19,073# X 40 BTUH/SF	=	762,920 BTUH
1544 (STM. PLT. BLDG)	(1/2)(56,526#) X 40 BTUH/SF	=	1,130,520 "
1550	19,633# X 40 "	=	785,320 "
1554	19,819# X 40 "	=	792,760 "
1558	14,102# X 40 "	=	564,080 "
1534	25,076# X 40 "	=	1,003,040

EMC

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range   REGION: 4   PROJECT NO: DACA 63-91-C-0152
PROJECT TITLE: TECH AREA CHILLER PLANT (ALT 4)   FISCAL YEAR: 1992
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 11/11/92   ECONOMIC LIFE: 25   PREPARED BY: T. FORSTER

1 INVESTMENT

A. CONSTRUCTION COST	=		$4,592,134	
B. SIOH COST	(5.5% of 1A) =		$252,567	
C. DESIGN COST	(6.0% of 1A) =		$275,528	
D. ENERGY CREDIT	(1A + 1B + 1C) =		$5,120,229	
E. SALVAGE VALUE	=		$0	
F. TOTAL INVESTMENT	(1D – 1E) =		---------->	$5,120,229

2 ENERGY SAVINGS (+) / COST (–)

FUEL TYPE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	$6.48	11,782	$76,287	15.23	$1,161,848	
B. DIST		0	$0	17.28	$0	
C. NAT GAS	$2.21	(57,428)	($127,054)	19.64	($2,495,335)	
D. PAPER		0	$0		$0	
E. COAL			$0	16.22	$0	
F. TOTAL		(45,646)	(50,766.9)		---------->	($1,333,487)

3 NON-ENERGY SAVINGS (+) / COST (–)

A. ANNUAL RECURRING (+/–) (ELEC. DEMAND SAVINGS + MAINTENANCE COST SAVINGS) = $55,587

1 DISCOUNT FACTOR (From Table A-2) = 14.68

2 DISCOUNTED SAVINGS (+) / COST (–) (3A x 3A1) = $816,017

B. NON-RECURRING (+/–)

ITEM	SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)
a. EQUIP REPLACEMENT COST	$100,000	1	0.96	$96,000
b. EQUIP REPLACEMENT COST	$193,500	5	0.80	$154,800
c. EQUIP REPLACEMENT COST	$713,250	10	0.64	$456,480
d TOTAL	$1,006,750			$707,280

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (–) (3A2 + 3Bd4) = $1,523,297

D. PROJECT NON-ENERGY TEST

1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = ($440,051)

a IF 3D1 => 3C THEN GO TO 4

b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = –0.35

c IF 3D1b => 1 THEN GO TO 4

d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (–)	(2F3 + 3A + (3B1d/25)) =	$45,090
5 TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$189,810
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	(5/1F) =	0.04
7 SIMPLE PAYBACK (SPB)	(1F/4) =	114

CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR: EMC ENGINEERS INC.

ADDRESS: 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227

CONTRACT FOR (Work to be performed): TECH AREA (ALT 4)

PROPOSED TOTAL CONTRACT PRICE:

PURCHASE REQUEST NUMBER:

PROJECT NUMBER:

WORK LOCATION: WHITE SANDS MISSILE RANGE, NEW MEXICO

Line No.	Item (1)	Unit of Measure (2)	Quantity (3)	Material Cost: Unit (4)	Material Cost: Total (5)	Labor Costs: Manhours Mandays (6)	Labor Costs: Average Rate (7)	Labor Costs: Total (8)	Other Direct Costs (9)	Line Total (10)
1	200 TON ABSORPTION CHILLER 400 TON ABSORPTION CHILLER	LUMP SUM	1	323750	323750					$323,750
2	1100 TON COOLING TOWER	EA	1	49444	49444					$49,444
3	PUMPS, VALVES, ETC.	LUMP SUM	1	229429	229429					$229,429
4	1600 SQ.FT. BLDG.	SF	1600	30.00	48000					$48,000
5	BURIED CWS & CWR PIPING	LUMP SUM	1	558700	558700					$558,700
6	VAULT W/EXP. JOINTS, VALVES, ANCHORS, ETC	EA	5	10800	54000					$54,000
7	INTERCONNECTION @ BLDG.	EA	9	14000	126000					$126,000
8	GAS TURBINE WITH 500 KW GENERATOR HRSG & AUX BOILER	LUMP SUM	1	422600	422600					$422,600
9	GAS BOOSTER COMPRESSOR	EA	1	50000	50000					$50,000
10	CONNECTION TO BASE ELECTRICAL SYSTEM ELECTRIC SWITCH GEAR	EA	1	95000	95000					$95,000
11	STEAM AND CONDENSATE PIPING SYSTEM	EA	1	1170828	1170828					$1,170,828
12	BUILDING HEATING SYSTEM CONVERVSIONS	EA	1	273830	273830					$273,830
	SUBTOTAL									$3,401,581
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									$850,395 $340,158
	TOTAL THIS SHEET									$4,592,134

SOURCE: Means Electrical and Mechanical Cost Data, 1992; Steward & Stevenson Services

E M C ENGINEERS, INC.
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JOB

SHEET NO. OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

ALT #4 EQUIPMT COST DATA

①	1 @ 500 KW G.T./GEN SET w/ FUEL COMPRESSOR	# 333,000
②	HRSG (4,000 LB/HR)	# 28,600
②	AUX BOILER 3,0 MBTU	# 36,000
③	EVAP COOLER FOR G.T. INLET	# 25,000
③	COOLING TOWER	# 49,500
③	ABSORPTION CHILLERS	# 353,200

① FROM STUART STEVENS, HOUSTON

② MEANS MECH. COST EST

③ FRY EQUIPMENT CO., DENVER

E M C ENGINEERS, INC.

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TECH AREA COGEN STUDY

ALT. # 4

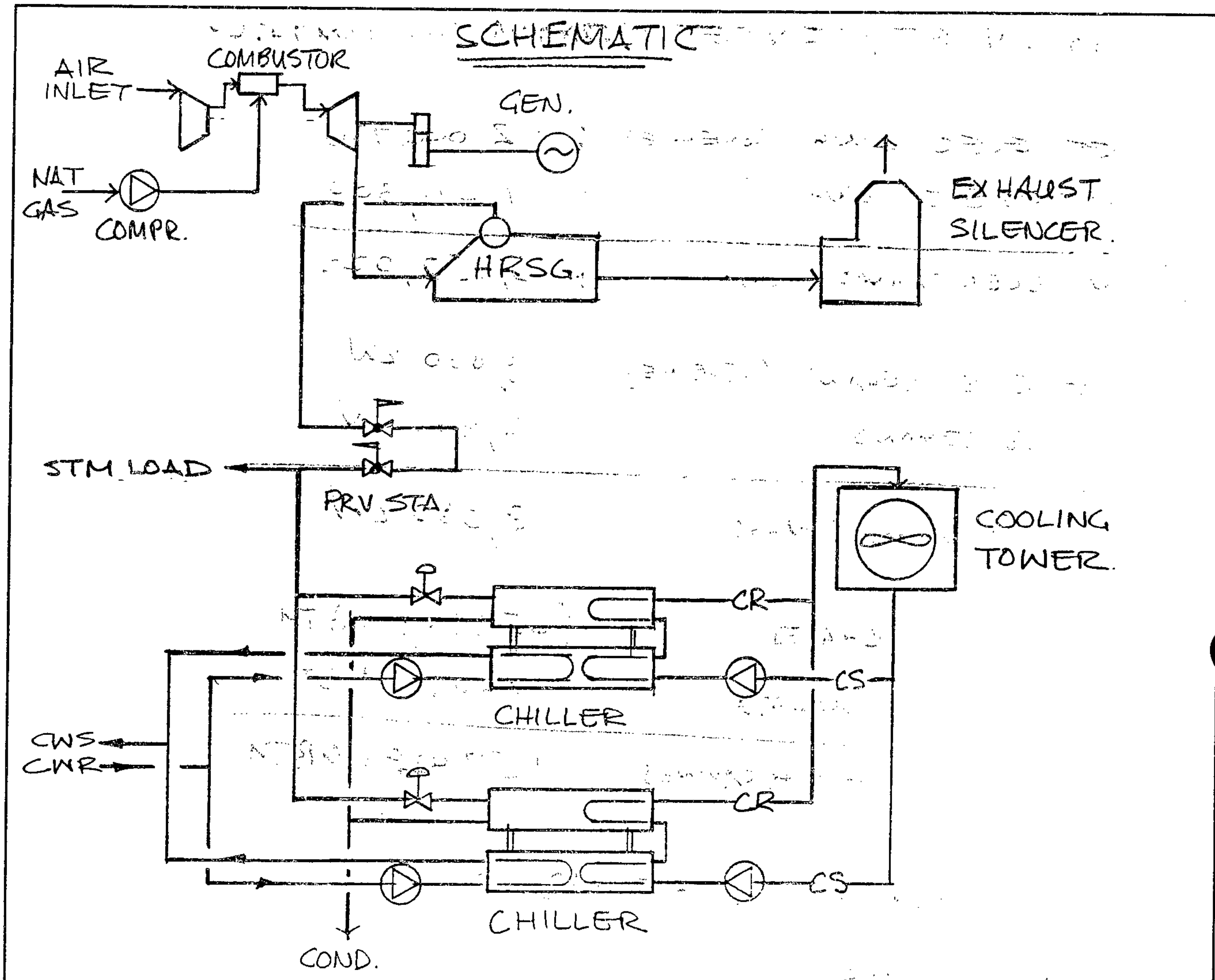
JOB WSMR ESOS STUDY #1110.000

SHEET NO. ____ OF ____

CALCULATED BY C. Butler DATE 3.9.93

CHECKED BY ____ DATE ____

SCALE ____



JOB WSMR ESOS STUDY #1110-000

E M C ENGINEERS, INC.

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SHEET NO. ____ OF ____

CALCULATED BY TF DATE 11-11-92

CHECKED BY ____ DATE ____

SCALE ____

ALT #4 PERF. SUMMARY

500 KW G.T./GENSET OPERATING CONTINUOUSLY

NET ELEC kWh (REVENUE): 2,040,720

AVOIDED ELEC kWh : 1,411,300

TOT. ELEC SAVINGS ~~(kWh)~~ 3,452,020

NET ELEC DEMAND (REVENUE) 3,080 KW

AVOIDED DEMAND 4,980 KW

TOT. DEMAND SAVINGS 8,060 KW

NET GAS PURCHASED (65,333) MBTU

AVOIDED GAS PURCHASE 7,905 MBTU

NET GAS SAVINGS (57,428) MBTU

CONSTRUCTION COST ≈ $ 4,600,000

SIR = 0.04

SPB = 114 YR.

E M G ENGINEERS, INC.

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ALT #4 EQUIPMENT DATA

5100 kW GAS TURBINE-GENERATOR SET

• 16,216 BTU/kWh HHV

• 4,22 kW DERATED FOR INLET LOSS

2' ALTITUDE

HRSG

• 4000 LB/HR OF 125 PSIG STEAM

• 1192.6 BTU/LB

AUX. BOILER

• 12 PSIG STEAM @ 1159.8 BTU/LB.

200 TON DUAL EFFECT ABSORPTION CHILLER

• 12 PSIG STEAM INLET COP ≃ 1.1

CONDENSES TO 206.1 BTU/LB AT OUTLET

400 TON DUAL EFFECT ABSORPTION CHILLER

• 12 PSIG STEAM AT INLET

• CONDENSES TO 206.1 BTU/LB AT OUTLET

• COP = 1.1

$$12{,}000\ \frac{BTU}{TON\cdot HR} \times \frac{1}{1.1} \times \frac{1}{(1159.8-206.1)} = 11.44\ LB/HR\text{-}TON$$

PLANT ELEC:

LIGHTS	2 KW
CHW PUMPS	39.3 KW
COND. WAT PUMPS	51 KW
C.T. FAN	88 KW
	180.3 KW ≃ 180 KW

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SHEET NO 3
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ALT #4 PERFORMANCE ANALYSIS

	JAN	FEB	MAR	APR	MAY	JUN
HOURS/MO.	744	672	744	720	744	720
AVE COOLING LOAD (TONS)	23.8	30.1	59.7	118.4	234.4	327.3
CHILLER PART LOAD	.12	.15	.30	.64	.59	.82
STEAM FLOW (LB/HR-TON)	11.44	11.44	11.44	11.44	11.44	11.44
CHILLER STEAM FLOW (LB/HR)	272.3	344.3	683.0	1354.5	2,681.5	3,744.3
HRSG STEAM PRODUCTION (LB/HR)	272.3	344.3	683.0	1,354.5	2,681.5	3,744.3
BOILER STEAM PRODUCTION (LB/HR)				0	0	0
BOILER FUEL (MBtu/mo)	0	0	0	0	0	0
Gas turbine * FUEL (MBtu/mo)	5,548.8	5,011.8	5,548.8	5,369.8	5,548.8	5,369.8
PLANT ELEC KW	136	136	180	180	180	180
GENERATOR (KW)	422	422	422	422	422	422
NET KW	286	286	242	242	242	242
NET KWh/mo	212,784	192,192	180,048	174,240	180,048	174,240

$16,216 \frac{BTU}{KWH} \times 422 KW \times \frac{1031}{946} =$

JOB WSMR ESOS STUDY # 1110-000

SHEET NO 3 OF 3

E M C ENGINEERS, INC.

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CALCULATED BY TF DATE 11-08-9

CHECKED BY ______ DATE ______

SCALE ______

	JUL	AUG	SEP	OCT	NOV	DEC
HOURS/MO.	744	744	720	744	720	744
AVE COOLING LOAD (TONS)	347.8	323.8	226.3	120.8	49.2	29.3
CHILLER PART LOAD	.87	.81	.57	.33	.12	.07
STEAM FLOW (LB/HR-TON)	11.44	11.44	11.44	11.44	11.44	11.44
CHILLER STEAM FLOW (LB/HR)	3,978.8	3,704.3	2,588.9	1,382	562.8	335.2
HRSG STEAM PRODUCTION (LB/HR)	3,978.8	3,704.3	2,588.9	1,382	562.8	335.2
BOILER STEAM PRODUCTION (LB/HR)	0	0	0	0	0	0
BOILER FUEL (MBtu/mo)	0	0	0	0	0	0
Gas Turbine FUEL (MBtu/mo)	5,548.8	5,548.8	5,369.8	5,548.8	5,369.8	5,548.8
PLANT ELEC KW	180	180	180	180	136	136
GENERATOR (KW)	422	422	422	422	422	422
NET KW	242	242	242	242	286	286
NET KWh/mo	180,048	180,048	174,240	180,048	205,920	212,784